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An International Review of Forestry and Forest Products

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1951 Yearbook of Forest Products Statistics

Fifth Yearbook of international forest products statistics to be published by FAO. It contains 1950 official information on production and trade and revised data for 1949, as reported by more than one hundred countries and territories in reply to a standard questionnaire.

The statistical tables are preceded by a short text which gives some salient features of the 1950 world situation. World and regional figures given here include estimates for non-reporting countries; in the statistical tables, the totals are for reporting countries only.

This Yearbook provides the most consistent and useful body of international forest products statistics now available. The tables cover the following topics:

- ROUNDWOOD
  Total Output
  Sawlogs & Veneer Logs—Trade
  Pulpwood—Trade
  Pitprops—Output & Trade
- WOOD PULP, NEWSPRINT, PAPER AND PAPERBOARD, AND FIBERBOARDS
  Production — Consumption — Trade
- PROCESSED WOOD
  Lumber, Plywood, and Sleepers — Production — Consumption — Trade
- WORLD TRADE — Summary
  Volume of Imports and Exports
  Value of Imports and Exports
- COMPARATIVE DATA
  Forest Products Balances
  Per Caput Consumption of Forest Products
  Forest Areas

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CONVERSION FACTORS

The conversion factors given below cover units normally used in Unasylva. The conversions for special units are given in the text. These tables may be amplified in later issues of Unasylva.

LENGTH	1 centimetre	= 0.3937 in.	1 inch	= 2.540 cm.
	1 metre	= 3.281 ft.	1 foot	= 0.3048 m.
	1 metre	= 1.094 yd.	1 yard	= 0.9144 m.
	1 kilometre	= 0.621 mile	1 mile	= 1.609 km.
	1 yard = 3 feet = 36 inches		**1 mile = 1,760 yards = 5,280 feet**	
AREA	1 cm^2	= 0.155 sq. in.	1 sq. in.	= 6.452 cm^2
	1 m^2	= 10.76 sq. ft.	1 sq.ft.	= 0.0929 m^2
	1 km^2	= 0.3861 sq. mile	1 sq. mile	= 2.59 km^2
	1 hectare	= 0.003861 sq. mile	1 sq. mile	= 259 ha.
	1 hectare	= 2.471 acres	1 acre	= 0.4047 ha.
	1 square kilometre = 100 hectares		**1 square mile = 640 acres**	
VOLUME	1 cm^3	= 0,061 cu. in.	1 cu. in.	= 16.39 cm^3
	1 m^3	= 35.31 cu. ft.	1 cu. ft.	= 0.02832 m^3
	1 litre	= 61 cu. in.	1 cu. in.	= 0.01639 litre
	1 litre	= 0.2642 gal. (U.S.)	1 gal. (U.S.)	= 3.785 litres
	1 litre	= 0.2200 gal. (Imp.)	1 gal. (Imp.)	= 4.546 litres
	1 litre = 1000 cm^3		**1 gallon = 4 quarts**	
MASS	1 kilogramme	= 2.205 pounds	1 pound	= 0.4536 metric ton
	1 metric ton	= 1.102 short tons	1 short ton	= 0.9072 metric ton
	1 metric ton	= 0.9842 long tons	1 long ton	= 1.016 metric tons
PRESSURE	1 kg. per m^2	= 0.2048 lb. per sq. ft.	1 lb. per sq. ft.	= 4.882 kg. per m^2
	1 gr. per cm^2	= 0.0142 lb. per sq. in.	1 lb. per sq. in.	= 70.31 gr. per cm^2
DENSITY	1 kg. per m^3	= 0.06243 lb. per cu. ft.	1 lb. per cu. ft.	= 16.02 kg. per m^3
POWER	1 cheval-vapeur (c. v.)	= 0.986 horse-power (h. p.)	1 horse-power	= 1.0142 cheval-vapeur

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An International Review of Forestry and Forest Products

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Cover Photograph: *"I will make thee a wilderness... I will prepare destroyers against thee, every one with his weapons." This quotation from the Book of Jeremiah is tragically apt to the bas-relief, of which a photograph is on our cover, from Ancient Egypt. Found on the tomb of the Pharoah Akhouthtep of the 5th dynasty, it shows unmistakeably how old is the problem of goats as enemies of afforestation in the Middle East... for thousand of years, in fact, they have been among the forester's greatest enemies. This bas-relief is now in the Louvre Museum, Paris.*

THE WEARY LAND

THERE is a story that it was because of what he saw when flying over once rich areas of the Middle East, on his return from the Yalta Conference in 1945, that President Roosevelt insisted on forestry being included in the Food and Agriculture Organization of the United Nations.

Of the famous forests of Lebanon which once extended over five hundred thousand hectares, only four small groves remain. In 1402 the conqueror Tamerlaine hid his elephants in deep forests in the vicinity of Ankara; today as far as the eye can see not a single natural woodland tree is standing.

A host of unfavorable effects has followed indiscriminate forest destruction, and it has been a primary factor in bringing misery and starvation upon many of the oldest and most thickly settled centers of population.

In the more mountainous sections of this old region, ancient civilizations have profoundly modified the vegetative cover, and unrestricted grazing on land suitable only for forest growths has resulted in widespread damage to the soil itself. Nomadic graziers, driven from the valley grasslands by the influx of farming, have been forced to seek the sparse pasturage of mountain ranges where the forests had already been depleted by centuries of exploitation. Tree reproduction becomes impossible, the light sod is cut to pieces by the hoofs of animals and the soil deprived of all protective cover, falls easy victim to the erosive forces of wind and rain. Within a few decades regions once well forested are transformed into barren, dustswept wastes.

To halt this process and reverse the trend is indeed a formidable task but one which governments and a devoted band of enthusiasts are prepared to face.

FAO now has technical assistance missions working in twelve countries of the Middle East in various phases of agriculture, forestry, fisheries, nutrition, and economics. What needs to be done and how to do it is mostly known. The question is to get it done on a scale commensurate with the need.

Can governments devote funds to long-term forestry ventures when there are immediate wars to be fought against the desert locust? The answer appears to be, "Yes". Slowly amongst peoples there arises an awareness of the need to protect and restore forests, and the present task is to turn this awareness into a campaign.

Reforestation in Arid Zones with especial reference to Eucalypts

by A. METRO, Director, Forest Research Station, Rabat, Morocco

These remarks are directed to serious students who realize that, in order to raise the standard of living of a great many people, it is an urgent necessity to undertake the collective reforestation of the subtropical zones of the globe.

There are other important tasks, naturally, but there are few in the general program and particularly within the sphere of FAO activities, that are so acutely urgent or cover such a vast field.

This is apparent to anyone who has flown over the vast expanses of countryside, from Spain to India, which have been ruined by deforestation and centuries of human mismanagement, from the days of Solomon to the world wars of our century. Everyone who has known this territory is in agreement, from Leon, the 16th century Spanish geographer to Chateaubriand in the 19th century and Wendell Wilkie in our own time. Slowly and inexorably man carries out the tragic threat uttered by Jeremiah to Mount Lebanon: "I will make thee a wilderness... and I will prepare destroyers against thee, every one with his weapons: and they shall cut down thy choice cedars, and cast them into the fire" (Jeremiah 22: 6,7).

Yet the ravages are even greater and more extensive than they appear to the statesman flying above these lands, or the historian objectively considering man's destiny.

The phytosociologist knows the depth and extent of the evil, having studied the composition of plan associations, their natural evolution and their development under various influences. He can prove how, species by species, every kind of wood growth down to the humblest shrubs has been systematically eradicated in the vicinity of certain rural centres. Thus degradation goes on, creating vast landscapes where the richly-coloured and luxuriant spring vegetation makes us forget for a short time the summers without shade, the torrential rains of autumn and the fireless winters.

The evil is apparent, too, to anyone who, at the beginning of winter, has seen bands of women and children pulling up roots, gathering thistles, or collecting cow-dung to dry and burn. There is the same very grave shortage of fuel, and of wood for other purposes, in the ramshackle shanty settlements on the outskirts of big modern African towns.

The sterility of the countryside is, indeed, the work of man, since small sacred groves may be found almost everywhere, "marabouts" in North Africa and small coppices surrounding Chinese temples and monasteries.

Various species of Eucalyptus, the author of this article considers, may provide many of the answers to afforestation of arid zones. How well they can do is seen in this fine grove of E. camaldulensis *in a North African plantation.*

Elsewhere great forest stands probably owe their survival to the fact that life was insecure and unstable for many centuries and there were very few inhabitants living within narrow boundaries.

These fine forest stands, such as those of cedar and of certain varieties of oak in North Africa, meet all the requirements; they have reached a state of equilibrium with the surrounding area which they protect, and natural regeneration follows regularly on methodically conducted felling. In other words, intensive modern silviculture may be applied there.

Falling between these two extreme types, which unfortunately occupy areas very different in size,[1] there are large expanses of intermediate forests which may give the scientific observer a false impression. Such stands, in fact, are usually no more than a collection of isolated trees without any proper forest floor, or associated vegetation, as is often the case in stands of thuya, cypress, juniper, etc. Such stands cannot prevent wind or water erosion nor can they regenerate themselves naturally in their present surroundings.

These ancient groves have been the witnesses—and the victims—of many vicissitudes, sharing the trials of the people who just manage to live at their expense.

[1] During the recent war there was a heavy drain on stands which formerly were very strictly preserved.

Although they may live for many more years, these trees are nevertheless in a state of retrogression, they are no longer a part of their living environment, they belong, in fact, to the past.

There is still time to conserve and to regenerate some of these last remnants of the forests by giving them the necessary care and rest, but, unfortunately, existing conditions threaten them with a very different fate. Their condition is bound to deteriorate because, as the local population progress in various ways they need more timber and their requirements are multiplied as they increase in numbers. Therefore, the trials facing the forest increase by geometric progression.

The necessity for finding food and employment induces more and more native workmen to clear and cultivate any so-called waste land; and such activity meets no opposition. Now, cultivated fields cannot be used for grazing, and soon, over vast tracts of land in many regions, pasturage will be possible only in wooded areas. Flocks will accumulate in these, and only such moral barriers as regulations and advice can be used against this policy of necessity.

It would also be a great mistake to attempt to define the extent of this problem using only the classical concept of "rate of forestation." Rate of forestation figures worked out for very extensive regions give a false average and make it impossible to ascertain which portions are very densely forested and which insufficiently or not at all. Also, by including those forests which either have been over-exploited or are heavily mortgaged in apparently accurate calculations, the gravity of the situation is obscured. The problem must be tackled from several angles, with particular reference to the dynamic evolution of the stands. There is a vast tract of land, broad enough to be called a zone, whose extent has not been even estimated, which forms an artificially dry and sterile belt around the world, passing through Spain, North Africa, the big Mediterranean islands, Libya, the Middle East, Iran, Pakistan, and China; the trees growing there supply neither the immediate nor the future vital needs of the local inhabitants (firewood, tannin, etc.) and there are too few of them to resist erosion caused by sun, wind, water, etc.

This report cannot enter upon either a more detailed discussion of general matters or their illustration by particular cases. Whether the problem is examined from the biological aspect, or whether it is considered comprehensively, as the economist or sociologist sees it, deforestation is proceeding at the same pace as material progress. Should it be allowed to become an accepted fact and should we resign ourselves to considering deforestation as a symbol of the blind progress of the civilized world or as an historic aspect of the frittering away of our resources?

Must we be content with applying short-term remedies? Is it sufficient to check the process by conserving existing forests? With our concepts of human solidarity and our desire for effective action, should we not, instead, tackle the problem of reforestation positively and seriously?

Reforestation

It is important to specify clearly that the problem in question is not merely that of providing sufficient quantities of wood, bark, or wood products, to that half of the world which has been deprived of such necessities by the carelessness of their forebears. Some experts[2] have shown that there still are enough forests on the surface of the globe to provide an almost inexhaustible supply, both for trading and for world fuel supply, of such commodities as boxwood, lumber, paper, and foodstuffs, etc.

It would still be necessary to stop the unchecked rate of waste now taking place and to arrange for rational management both from the industrial and the forestry standpoint, with particular emphasis on natural regeneration and on the prevention of soil lateritization in tropical countries. It could be claimed that on a global scale the area under timber would still be sufficient from an economic standpoint.

But the economic standpoint alone is insufficient. The problem of rational land use and land capability classification exists in all the deforested zones of countries forming part of the "sterile belt". Many writers have pointed out that in the formulation of their program for certain Mediterranean countries, agronomists and economists should bear in mind the concept of an equilibrium between forest, bush, and pasture areas.[3]

A discussion of this very important subject would be useful, but even where are concerned only with land suited to forestry purposes, such a phrase is understood differently according as to whether it is used by botanists or by foresters. A clear definition of its use here must, therefore, be made.

When the soil over a greater or lesser period of time is untouched by man, then, in most parts of the world and especially in those of interest to us, brushwood growth springs up and is followed later by a number of forest types, finally working up to what is known as the forest *climax*.

Perhaps the word "forest" itself derives from this phenomenon since the Latin *foris* (outside) originally designated those lands beyond the living area and the cultivated fields.

But this forest climax is not always reached. Certain soils, either because of the altitude or latitude or because of their chemical composition, never lead to this forest climax, but give rise to prairies, steppes, or deserts. Such soils are not suited to forestry purposes while others are.

The forester working not only on behalf of trees but also by means of trees for the good of mankind uses an even stricter definition: of those areas which are biologically suitable for forest and were cleared for cultivation a very long time ago, some as in temperate Europe, can be used for agriculture or pasture indefinitely. These lands are definitely suited to pasture or agricultural use.

There are, however, other soils which, in a stable world economy, are more suitable for forestry on a medium or long-term basis than for other forms of use such as arable land, pasture, etc., which would eventually ruin the soil by erosion.

Such areas are definitely forest land and should be designated for development as woods or forests.

When forest returns are calculated, not only must cash profits be taken into account, but also those

[2] Notably Egon GLESINGER in "The Coming Age of Wood".

[3] KUHNHOLTZ LORDAT: "La Silva, le saltus, et l'ager de Garrigue".

The two photographs in this page give some idea of what can be done in North Africa with modern methods of afforestation. Above is part of one of the big areas of replanting in Morocco, using acacias (dark zones) and eucalypts (lighter areas). The lower photograph shows another Moroccan site, the degraded forest of Mamora, with patches of oak, insufficient to form a forest, now inter-planted with Eucalyptus camaldulensis. *In the foreground the effects erosion are already visible.*

indirect and intangible benefits such as soil protection, both of forest land and of adjoining areas, climatic factors (windbreaks), etc. This land use value is thus a matter of topography, of soil type, of climate, and in many cases of economic and historical factors.

Thus, certain soils which have become so degraded on account of misuse that they are now suitable only for forests or mining. Forestation, in this case, may be the last remaining alternative.

For this reason the reforestation of each country must not be considered as an isolated technical problem, but as part of an overall forest policy integrated in general planning and taking into consideration many factors which we will not discuss here.

There are, however, some difficulties common to all reforestation problems.

Difficulties arising from the physical environment

First of all, within the geographic limits established earlier, the forester must carry out his task under extremely arduous physical conditions.

Most of the countries under consideration have a Mediterranean climate with long, sunny summers, dry and hot, with temperatures often rising to 45°C. in the shade and with no rainfall from the beginning of June until October. Nevertheless, the winters are also often rather severe.

This type of climate is not only difficult in itself, but is also extremely changeable; the mean temperatures and rainfall vary from year to year. There is often a considerable annual rainfall, but it occurs in the form of heavy downpours occurring on a few days only in which most of the water is lost by runoff. The amount of useful rainfall is very uncertain.

All these extremes are aggravated by the deterioration of those regions to be reforested; the "mesoclimate" is not softened by any vegetative cover or there are hot, dry winds. The deterioration limit has been reached and, beyond it, tree growing, even of native species, becomes almost impossible.

Difficulties arising from the Human Element

It is obvious that most of the destruction has been wrought by people pressed by their material needs. They have often reduced their inheritance to such a level that immediate considerations take precedence over any future plans.[4] Many of the countries in the Middle East, moreover, are inhabited by people of nomadic origin to whom the whole concept of forestry as a means of using the land is completely foreign.

Difficulties inherent in all very large land-use problems

In order to cope effectively with problems of rural economy and land use in these areas, the work must be undertaken on a vast scale. Not only are the present needs in wood of the inhabitants very great, but they will increase rapidly and the areas suitable for forestry are almost always extremely big. It will be quite useless to expect any direct benefits from reforestation of such areas, if this is not carried out extensively. Reforestation is only effective against wind and water erosion when it covers considerable areas. Again, planting of commercial forests cannot be justified unless the yield is sufficient to meet the indispensable requirements of average factories, such as those for the processing of cellulose.[5] This has been well understood and demonstrated by certain big Spanish and Portuguese companies.

Under the conditions we have outlined, reforestation is expensive; climatic deficiency must be overcome by a careful use of the land, either by digging trenches along contour lines on the slopes or, on flat territory, bay deep plowing.

The implementation of a complete reforestation scheme, therefore, involves problems of financing, which in most cases can only be solved by the State. Under present conditions capital is indispensable; the paper industry has made little investment in recent years in forest production or reforestation in Western Europe, and the present impoverishment is due to this fact. We mention in passing that modern administration of national forest funds aims at uniting private capital and public money in a fluid partnership.

One thing is sure, however: neither the State nor private capital will undertake reforestation seriously unless they are assured quick and substantial profits.

Choice of species

For this type of reforestation, the forester must use species fulfilling the following essential requirements:

(1) adaptation to physical environment (species resistant to summer drought)
(2) adaptation to the human element (species throwing out new shoots freely and resistant to fires)
(3) financial returns

Botanists and foresters alike agree that the best results for soil protection and for bringing the land back into use as forest will be obtained in most cases by making use of species which are already part of the aboriginal vegetation.

Unfortunately, in so far as Mediterranean vegetation is concerned, most species grow fairly slowly and in all cases yield is small and returns slow, the only exceptions being certain varieties of pine and cedar which cannot be used unless there is an adequate rainfall. The choice, therefore, inevitably falls on exotic species.

From a general standpoint, European foresters have a great tradition in the science of acclimatization, starting as early as the 16th century and continuing

[4] In certain parts of Morocco the State is undertaking the reforestation of collectively-owned land; this will contribute considerably to the fortune of the tribes owning the land. Nevertheless, these tribes expect to receive an annual indemnity until such time as the increased is completely theirs.

[5] In this connection it should be pointed out that establishing a wood-processing plant for producing pulp or viscose is not possible unless a production of at least 20,000 metric tons annually is contemplated. Such a production corresponds approximately to a wooded area of from 6,000 to 10,000 hectares. It may be calculated that the industrial reforestation unit is about 10,000 hectares and that this area corresponds to an investment of roughly $2.85 million.

with ups and downs until the present time. They know that exotic species must be tried out methodicaly in arboreta andthat the choice of species should not be limited to over-strict geographic or ecological concepts. Nature cannot be dealt with by Cartesian philosophy; an overscientific concept of the problem should occasionally be corrected by the use of imagination and courage, always bearing in mind the great adaptability of many species.

Further exploration essential

In order to supply arboreta in deforested subtropical countries, and particularly in order to increase their very small number, teams of ecologists, foresters and plant experts should go prospecting under the guidance of local botanists. Those richly wooded tropical and sub-tropical areas of Australia, southern California, Mexico, the foothills of the Himalaya, etc. would provide them with a wide choice. The exchange of seeds of forests species should be increased, and a cordial relationship be established more and more on the international level between research stations, collectors, and the seed trade. Personal contacts, both in the field and in laboratories, should improve the relationship between these groups. Work is already being done in this direction. The way has been shown. It only needs to be followed more quickly.

It is with this thought in mid that FAO has organized a study tour to take place in September, 1952, when a group of foresters from many nations will be taken across the Australian continent. The object is that they be shown:

(1) the variety of habitats existing on this continent and the many uses to which local species may be adapted, mainly the very numerous varieties of *Eucalyptus;*

(2) how the Australians, applying the findings of research conducted by their great scientific and industrial organization, the C.S.I.R.O., have been able to make full and varied use of their only apparent resource;

(3) how a great modern country is practically living in a eucalyptus age, using this wood for their houses, their bridges, mines, telegraph poles, paper both for newsprint and writing, cardboard, plywood, etc.

Already the program in this field is well under way; it started under the auspices of Ferdinand von Müller, around 1860. Many varieties of eucalyptus were introduced in a great number of countries (Brazil, Belgian Congo, Cameroons, Ceylon, Chile, Ecuador, France and North Africa, India, Israel, Italy, Jamaica, Kenya, Nigeria, Paraguay, Peru, Puerto Rico, Portugal, South Africa, Spain, Turkey, Uganda and the United States).

Some observations concerning the progress made in this world experiment may be useful, although the Mediterranean section is the only one really familiar to the author:

First of all it appears that several species of eucalyptus are suitable for reforestation in those sub-tropical countries already mentioned on account of their exceptional qualities and their ability to thrive under difficult conditions.

Several of these (for instance: E. *camaldulensis, globulus, cladocalyx, gomphocephala, sideroxylon*) are extremely adaptable and appear able to acclimatize themselves in surroundings very different from their own natural habitat, which is rather restricted.[*]

The above species are fairly hardy, they are easy to grow, and in most sub-tropical countries they quickly reach a size sufficient to eliminate the danger of damage from grazing animals; this ensures a very heavy yield. Vegetative cover does not grow well in their shade, and this is a factor preventing brush fires. They throw out new shoots easily and can stand the effects of fires, which are the most permanent source of trouble for reforestation projects. The above qualities prove how well these species are adaptable to what may be called the human element.

A great popular movement is taking place in Morocco near those large reforestation tracts which were started during the last 20 years, either by private owners or by the State, on government or collectively-owned land belonging to the tribes; this movement is known as *callito* by the Moroccan agricultural laborers. Young seedlings are distributed, and sometimes even stolen from the nurseries, and are set out individually around a group of houses or a village. This movement has only just started, but it does not appear over-optimistic to hope that a collective forest conscience will eventually develop, stimulated by the interest now centered on each tree individually.

Creating an Interest in Trees

Let each forester examine his conscience properly. Is there one who, as he acquires a deeper knowledge of his profession, is not more and more conscious every day of the complexity of forest biology problems? Can these problems be understood intellectually by those groups whose outlook is limited to problems of work and daily bread? Can they even be understood by those groups having a higher degree of culture? The personal opinion of this author is that it will be possible to persuade entire races to respect and love their natural forest heritage fairly quickly and easily, and that this can be brought about by having them take part in the planting of trees yielding both reasonably swift returns and obvious material advantages. From the teaching standpoint one must begin with the idea of the single tree and proceed to that of forest.

Psychologically this sequence seems even more important.

Limitations of Eucalypts

The tremendous advantages that may be derived from the use of a small number of eucalyptus species and the fine results in forestry that are attributable to them must not blind us, however, to the fact that they cannot meet every requirement. On the one hand, although eucalypts may be used over a large area, nevertheless their use has ecological limits; these species cannot stand either extreme cold in winter or

[*] With the possible exception of *E. camaldulensis.*

In this article M. Metro has remarked how in parts of Morocco, the "fellahs" are beginning on their own to plant trees, notably eucalypts, round their dwelling and thus showing the success in creating an interest in forestry where none previously existed. Such a plantation is that seen above, the owner standing proudly in front of the trees which now surround his homestead.

great droughts in summer; on the other, the eucalypts do not meet certain technological requirements.[7]

It is well known that wood produced by the same species in different localities hardly ever has the same qualities and differs according as to whether it is grown in Australia, its natural habitat, or in South Africa. When growth is very rapid, the effort which takes place within the cells appears to have an adverse effect on the wood produced.

Have other species of eucalyptus, included among those introduced into various countries during the past 75 years, better qualities, perhaps, or greater suitability from the technological and ecological standpoints?

May there not also be varieties or natural hybrids among these species cultivated in plantations and which may be able to give good results financially when they have been studied technologically and ecologically? It is from this double standpoint that international collaboration becomes a necessity. All the extremely interesting studies carried out in Australia on eucalypts, mainly by the forest services and by the C.S.I.R.O., should be brought to the knowledge of all reforestation specialists, but it is equally urgent that the degree to which they can acclimatize themselves to various regions of the world be carefully worked out.

The time appears ripe to supplement the observations made in Australia by a summing up of world-wide experiments which have been conducted for nearly a century and which so far have been insufficiently considered.

[7] Another drawback to the use of eucalyptus species, for instance, is the small amount of humus they provide. This is a debatable point, but in any case the matter may be remedied by planting acacia understoreys in eucalyptus stands.

Very weighty studies have been published in South Africa, South America, New Zealand and the United States, and in various Mediterranean countries. Probably there are others, and it is because the author deprecates such involuntary omissions that it is his personal desire to have a comprehensive and exhaustive study of the problem made.

Conclusion

To sum up, it is certain that many regions in the greater part of the sub-tropical zone are suited to forest. They should be set aside for reforestation both for economic and social reasons.

The work to be undertaken is both urgent and of vast scope. It is difficult from the human and from the technical standpoint. Foresters have a certain number of eucalyptus species with which to solve the problem. These are fairly simple to put in production and they meet the essential requirements; they may be made use of immediately. No theoretical, sentimental or aesthetic considerations should be allowed to stand in the way of all those who feel responsible towards other members of human society.

Not merely the simplest solution should be considered, however. All parts of the world must be surveyed methodically and useful species chosen. But, in any case, better use should be made of the genus *Eucalyptus*, whose worth has been proved by experience over the past hundred years.

In this way, a collective solution, both in time and in space, will have been found to satisfy the main principle of productivity, that when the laborer's work is done, he should be certain of having accomplished a useful task.

Forestry in the Middle East

Certain groupings of countries in Africa and Asia have for long been referred to by geographers as the Near East and the Middle East. These terms are variously interpreted. FAO maintains a Near East Regional Office with Headquarters at Cairo but whose responsibility jurisdiction extends to Afghanistan. Now Moslem member governments of FAO in this region contemplate creating a regional forestry body to co-ordinate intelligence and plans and to work towards an interchange of ideas, of men and equipment in a common battle. For the purposes of this article, which has been compiled by the Forestry Division staff from current literature and reports, the individual countries interested in this scheme are referred to collectively as the Middle East.

THE countries of the Middle East are in the main already fully cognizant of the potential value of their forests and have adopted or plan to introduce legislation designed to protect the resources that remain or new forests that can be created, and to ensure their rational utilization. It is only on the basis of effective legislation that sound national forest policies can be gradually developed and it is one of FAO's functions to proffer advice on the lines along which forest policy should be developed and to help any individual country that requests assistance.

Generally speaking there is a dearth of forestry technicians and experts in this region. Some countries have tried to overcome this difficulty by obtaining the services of foreign experts or by sending students abroad to attend forestry schools and universities. For the future, it is probable that countries will have to become increasingly self-dependent, or at least regionally independent. For this reason, regular regional technical meetings could help foresters to make those personal contacts which will be so valuable when the new forestry programs get under way.

In the past FAO has tended to pay regard more to agriculture than to forestry in the Middle East. Now forestry is to receive much stronger emphasis. National inventories of forest resources and comparisons of timber production and requirements should enable reasonable appraisals to be made of import requirements and, in some instances, of export possibilities.

At present, however, it would be to the mutual advantage of all countries in this region to study their common technical problems and to exchange the findings of their research and results of their experiments. A few typical problems should be selected for joint study on the international plane. The following, for instance, merit special attention.

Afforestation and Reforestation

In many instances, afforestation and reforestation must be undertaken to rehabilitate existing forests or create new ones and this raises many social problems. It can provide steady employment and help counterbalance the unemployment caused when grazing is limited in the interests of forest and soil conservation. An immediate exchange of views is desirable on the tree species and varieties best adapted to local conditions, the best planting techniques, and methods of protecting and conserving new forests.

The broader aspects of afforestation must be studied, including the planting of purely protective forest areas, commercial plantations, windbreaks, and shelter belts for agricultural crops. Moreover the vast areas planned to be irrigated for agricultural purposes certainly offer full scope for the planting of windbreaks and shelter belts, which may be expected to produce a far from negligible timber yield.

A general policy of encouraging tree-planting should be adopted and all farmers be urged to plant small woodlots and even single trees. Communities might be encouraged, by various incentives, to plant woodlots near villages to furnish firewood on short rotations.

The shortage of tree nurseries is a serious impediment to work that is already underway, and procedures for the exchange of seeds and plants must be examined in detail. FAO proposes to do this during the coming months.

Some of these problems have already been considered by FAO's Subcommission on Mediterranean Problems and by the International Poplar Commission. The question of how eucalypts can best be utilized is also receiving considerable attention, as indicated in M. Metro's article earlier in this issue.

In the Middle East extensive areas exposed to erosion fall within the domain of the Forest Services. It is planned that these areas shall ultimately be afforested but afforestation cannot be successful unless auxiliary measures are first taken — the terracing of slopes and the creation of water-conserving embankments and other devices. This has already been widely done in some countries but there is still room for improvement and an exchange of information on results would be invaluable. More demonstration areas are needed.

In some places, the soil is so seriously degraded that more than conservation and afforestation is required; preliminary soil fixation measures are needed to make afforestation possible at all. Appropriate methods of dealing with erosion are not generally known or applied in this region and the dissemination of information on this subject is imperative. Finally, the problem of sand-dune fixation is often encountered.

The whole complex problem of afforestation, soil conservation, and water conservation needs to be studied together.

Range lands and grasslands

Improvement of pastures is of constant concern to foresters in this region. During the dry season, if not throughout the year, any forests that exist are widely grazed so that the forester is forced to attempt to control the influx of animals. The problem is very

The Middle East

The area shown in the map above comprises more than that usually referred to as "The Middle East", but it shows the relationships of the area with the neighboring African territories in which many similar forestry problems occur. This map should be used especially when studying the Tables in pages 106 *and* 108, *in which statistics are given for the African countries shown above.*

difficult to tackle because there can be no question of simply eliminating grazing without making provision for other pastures or for the employment of the manpower thus made idle.

Some countries have already taken steps in this direction, and others are contemplating action. International collaboration would be mutually beneficial here, since solutions adopted in one country can also be applicable in another. In any case, the problems sometimes involve several countries, for example, where the herds and sometimes even the entire nomadic tribes with their herds move from one country to another.

Technical research is also called for in the improvement of pastures and the introduction of forage trees or bushes in new woodlots, and on means of controlling, restricting or prohibiting the pasturing of flocks.

The use of forest products

This entire region suffers from a chronic shortage of wood and it is very important that the limited output should be used to the greatest advantage. More research is essential to improve methods of utilizing existing supplies of wood, particularly of such deciduous trees as oak, poplar and eucalyptus. Such research may lead to the better utilization of native timber as saw timber, railway ties (sleepers), plywood, fiberboard and light packing boards. Improved charcoal manufacture must also be studied, as is now being done in Iran where, in addition, a technical assistance officer of FAO is lecturing to University students on wood technology.

In order to present a background of information

Table 1 — Land Use and Population

Country	Period	Total area	Agricultural Area		Forest and woodlands			Unused but potentially productive	Built-on area, waste-land and other	Population in 1950 (mid-year estimate)
			Arable land (incl. fallow) and orchards	Permanent meadows and pastures	Area	Percentage of total area	Per caput			
		(..... Thousand hectares .....)				Percent	Hectares	(Thousand hectares.)		Thousands
AFRICA:										
Egypt	1948	100,000	2,445	—	—	—	—	—	97,555	21 439
Eritrea	1949	12,432	248	9,130	1,400	11.3	1.27	170	1,484	1,184
Ethiopia	1950	108,000	11,000	54,000	8,000	2.8	0.20	30,000	5,000	15,000
Somalia	1948	69,936	7,977	32,980	27,000	38.6	21.67	[2] 32,980	1,979	1,425
Somaliland, British	1949	17,612	200	16,800	800	1.7	0.60	[2] 200	412	(500
Somaliland, French	1950	2,900	[2] 2	[1] —	82	2.7	1.11	2	2 234	70
Sudan	1948	250,858	717	[1] 24,038	94,100	37.6	11.27	600	131 128	8,850
ASIA:										
Aden (incl. Perim and Kuria)	1947	21	—	—	—	—	—	—	21	750
Aden Protectorate	1947	29,008	[3] 110	—	—	—	—	—	28,898	
Afghanistan	1948	60,000	[4] (1,150)	—	[4] (1,000)	1.7	0 08	—	57,850	12,000
Bahrein Island	1947	60	—	—	—	—	—	—	60	110
Cyprus	1950	925	434	94	167	18.0	0.34	34	196	484
Iran	1950	164,800	16,760	10,000	19,000	11.5	1.01	88,040	80,040	18 772
Iraq	1950	43,542	(2,338)	(4,000)	(1,778)	4.1	0.35	—	35,426	5,100
Israel	1949	(2,050)	...	...	(89)	4.3	0.07	...	...	1,257
Jordan	1947	9,111	480	600	35	0.4	0.06	—	7,996	610
Kuwait	1949	2,072	—	—	—	—	—	—	2,072	170
Lebanon	1950	1,038	280	7	74	7.1	0.06	—	677	1,257
Muscat and Oman	1948	21,240	—	—	—	—	—	—	21,240	550
Pakistan, West	1952	(79,495)	...	...	(1,699)	2.1	0.05	...	...	[6] 34,240
Qatar	1947	2,200	—	—	—	—	—	—	2,200	20
Saudi Arabia	1947	154,600	(20)	—	—	—	—	—	154,580	(4,000)
Syria	1950	18,388	3,536	5,631	422	2.3	0.12	3,876	4,803	3,510
Trucial Oman	1947	1,500	—	—	—	—	—	—	1,500	80
Turkey [5]	1949	77,698	15,260	38,613	10,358	13.3	0.49	-	13,467	21 035
Yemen	1947	19,500	—	—	—	—	—	—	19,500	4,500

[1] Includes acacia/short grass scrub.
[2] Included also under Permanent Meadows and Pastures.
[3] Area planted to main crops only.
[4] Prewar.
[5] Inland water bodies included in the various land use categories.
[6] At the end of 1948.
— None.
... Not available.
( ) Unofficial figures.

Sources: FAO Yearbook of Food and Agricultural Statistics 1951; forest area of Israel from FAO Yearbook of Forest Products Statistics 1951, data concerning West Pakistan from a semi-official report.

Table 2 — Livestock Numbers
(Thousand head)

Country	Horses	Asses	Mules	Cattle	Pigs	Sheep	Goats	Buffaloes	Camels
AFRICA:									
Egypt	25	1,026	12	1,330	60	1 925	1,475	1,240	197
Eritrea	1	82	8	1,210	3	900	1,150	—	105
Ethiopia	1,000	3,000	1,000	18,000	6	15,000	10,000	—	2,000
Somalia	2	11	12	1,200	2	2,000	2 435	—	1 176
Somaliland, British	—	—	—	[5] 250		3,000	2,000		2,000
Somaliland, French	—	6	—	10	—	100	200	—	3
Sudan	20	500	—	4,000	1	5,000	4,300	—	[1] 1 500
ASIA:									
Aden Protectorate	—	—	—	58	—	130	650	—	70
Afghanistan	500	1,000	200	2,600	. .	14,500	6,000	—	450
Cyprus	5	51	8	33	[6] 35	[7] 287	[7] 174	—	1
Iran	265	1,200	126	3,300	5	18,000	11,000	10	600
Iraq	[1] 184	[1] 113	[1] 54	1,100	-	8,520	1 849	130	200
Israel	[2,3] 13	16	[2,3] 13	60	—	55	80	—	...
Jordan	2	26	2	66	—	110	332	—	4
Lebanon	[1] 10	[1] 20	[1] 5	20	2	[1] 25	[1] 300	—	2
Pakistan [4]	470	913	41	24,286	105	6,150	10,057	5,000	454
Syria	90	260	40	101	-	2,953	1,000	7	72
Turkey	1,182	1,033	111	10,380	6	26,121	20,000	897	105

[1] Registered for taxation.
[2] Used in agriculture.
[3] Horses and mules.
[4] Includes both West and East Pakistan.
[5] Range given as 200-500 thousand head.
[6] Over three months old
[7] Over 1 year old.

Source: FAO Economics Division. Figures either refer to the year 1950-51 or are the latest figures available.

on the countries of the region, some condensed sketches of general conditions in the Middle East countries are given below. These are summaries of data reported to FAO, collated by the Forestry Division staff.

Afghanistan

The dominant feature of Afghanistan is the Hindu Kush, a great central range of mountains crossing the country from east to west in a series of deep ravines and broken ridges.

The climate has extremes of temperature, wind and dryness, for which the elevation rather than the latitude is mainly responsible. The maximum temperature may vary from 44°C. in the Oxus valley to 38°C. in Kabul; the minimum temperature may be as low as -23°C. to -26°C. In the north the daily variation of summer temperature exceeds 17°C. The heat is particularly aggravated on the western frontier where a hot wind with a velocity which reaches 180 km. per hour blows continuously from June to September.

The average yearly rainfall is 280 mm., the greater part falling between December and April. An occasional shower falls in summer, but the influence of the southwest monsoon hardly extends to Afghanistan.

On the main ranges at 1,800 to 3,000 m. grow large forest trees, the conifers being *Cedrus deodara, Abies excelsa, Pinus longifolia, Larix sp.* and Yew Hazel, juniper, walnut, wild peach and almond are also found. In their shade grow several varieties of rose, honeysuckle, currant, gooseberry, hawthorn and luxuriant herbage. Walnut and oak (evergreen and deciduous) descend to the secondary heights, where they become mixed with alder, ash, khinjuk, *Arborvitae*, juniper, *Indigofera* and dwarf laburnum, with species of *Astragalus*. Lower down occur wild olive, species of rockrose, wild privet, acacias and mimosas, barberry and *Zizyphus*; and, in places, *Chamaerops humilis* (which is used for a variety of purposes), *Bignonia*, sissu, *Salvadora persica*, verbena, acanthus, and varieties of *Gesneria*. The lowest terminal ridges, especially toward the west, are naked in aspect and their scanty vegetation is almost wholly herbaceous. On the dreary Kandahar tablelands many vigorous leguminous plants grow, the camel-thorn (*Hedysarum alhagi*), *Astragalus, Ononis spinosa* (the fibrous roots of which often are made to serve as tooth-brushes), the sensitive mimosa, and others. In ravines are found *Nerium oleander*, wild laburnum and *Indigofera* spp. The chief cultivated trees are mulberry, willow, poplar, ash and occasionally the plane.

The gum resin of *Narthex asafoetida* from the high and dry plains of western Afghanistan is of commercial value. In the highlands of Kabul edible wild rhubarb is of importance as a local luxury; walnut and edible pine-nuts are both exported. *Elaeagnus orientalis*, common on the banks of watercourses, furnishes an edible fruit, while *Pistacia khinjuk* affords a mastic. The true pistachio is found only on the northern frontier.

Apart from the mountain and forest areas, Afghanistan is mainly a pastoral country. Of the total area of 60 million hectares only about 2 percent appears to be under cultivation and the remainder consists of desert land in the south and southeast, and of hi[illegible] country providing seasonal grazing throughou[illegible] year. The soil on the whole is fertile, parti[illegible] in the wide loess plains north of the Hindu Kush in the east and south. In these places and along the valleys wherever irrigation is possible, good crops are obtained. Irrigation is carried out by means of a network of channels, often many kilometres in length, and sometimes subterranean, and FAO is advising the government on the construction of irrigation dams and canals to conserve flood waters. Dry farming is also practised in certain areas. The principal wealth of Afghanistan lies, however, in the flocks and herds which roam the great pasture lands below the mountains: from the pastures around Andkhui come the highest quality lambskin or astrakhan (Karakul) while the southern sheep provide wool, mutton and melted butter.

The forestry problem in Afghanistan is therefore definitely a matter of use of forest cover for water conservation and the reconciling of forestry and grazing.

Cyprus

Cyprus is situated in a region where the climate is suitable for forest crops. Though the rainfall is very variable in different parts of the island, it is sufficient everywhere to support a good forest cover. The country was once densely forested but today there remain only 167,000 ha. of forest (18 percent of the total area); 97 percent of these forest lands are state-owned.

Cyprus is composed of two main mountain ranges separated by a broad plain of agricultural land: (*a*) the northern range of Kyrenia mountains, a narrow rocky limestone ridge and rising to over a thousand meters, and (*b*) the southern range of Troodos mountains, formed mainly of igneous rocks and rising to almost two thousand meters. The main forest areas are situated mostly on the upper elevations of these two ranges. The climate is typically mediterranean, with winter rainfall and a long dry period during the summer months. Rainfall is closely correlated with the topography of the island and varies from about 250 mm. at Morphou (30 m. elevation) to over 1,000 mm. at Troodos (1,750 m.). The rivers are torrents, in high flood during times of rain and with dry stony beds in summer. The only perennial stream flows are those flowing out of the extensive forest areas on the southern mountain range.

The main natural forests are predominantly coniferous high forests with an understory mostly of broadleaved species. The moist valley bottoms support a riverain high forest in which broadleaved species predominate. Amongst the principal conifers, *Pinus brutia* is the main timber tree in all areas up to 1,400 m. elevation, while *P. laricio* is confined to elevations above 1,200 m. in Troodos and Adelphi forests only. Other softwood species which grow on the island are *Cedrus brevifolia*, above 900 m. in Paphos forest, *Juniperus foetidissima*, above 1,200 m. in Troodos and Adelphi forests only, *Cupressus sempervirens* particularly on the northern limestone mountains, and *Pinus*

Table 3 — Roundwood Output per Hectare and Consumption of Forest Products per Caput

Country	Total roundwood output	Total forest area	Output per ha	Average consumption (1947-1950)					
				Roundwood			Lumber	Plywood	Wood pulp and pulp products
				Total	Fuelwood	Industrial wood			
	Period	1000 m3 (r)	1000 ha	m3 (r) per 1000 capita			m3 (s) per 1000 capita		Tons per 1000 capita
AFRICA:									
Egypt	1950	...	...	...	...	...	[1] 40	[1] 2	[1] 1	2
Eritrea	1950	25	1,400	0.018	...	[4] 20	...	[3] 3	...	...
Ethiopia	1950	...	8,000	...	...	...	70	[7] 2	...	...
Somalia	1950	133	27,000	0.035	...	...	...	...	...	...
Somaliland, British	1949	7	900	0.023	...	[4] 10	...	...	...	...
Sudan	1949	405	94,100	0.004	...	[5] 50	...	[5] 3	...	...
ASIA:										
Cyprus	1950	[1] 40	167	0.240	230	80	150	76	[6] 1.0	[1] 2
Iran	1950	311	19,000	0.016	[6] 10	[6] 8	2	..	...	...
Iraq	1949	95	(1 778)	0.053	...	...	...	...	...	...
Israel	1950	...	(89)	...	...	...	...	[7] 130	[7] 4.6	[7] 17
Jordan	1950/1	36	35	1.029	[3] 180	[6] 110	70	[3] 22	...	...
Lebanon	1950	34	74	0.459	[5] 100	[5] 20	80	[4] 42	0.8	4
Pakistan 2	1950	1,304	3,539	0.368	...	[6] 13	...	[3] 4	...	...
Turkey	1950	6,106	10,356	0.589	320	210	110	12	..	2

[1] Excludes wood taken from trees outside the forest.
[2] Includes both West and East Pakistan.
[3] Year 1950.
[4] Average based on figures for one year.
[5] Average 1947/1949.
[6] Average 1949/1950.
[7] Average based on figures for two years.

( ) Unofficial figures.
... Not available.
Italics: Totals known to be incomplete.
\+ Includes wood for charcoal and distillation.
++ Data for sleeper production are often included with figures for lumber production.

Sources: FAO Yearbook of Forest Products Statistics 1951 and FAO Yearbook of Food and Agricultural Statistics 1951.

Table 4 — Output of Coniferous and Non-coniferous Wood

(Thousand m³ (r))

Country	Period	Total			Sawlogs, veneer logs and hewn squared timber	Pulpwood	Pitprops	Hewn sleepers	Poles, piling and posts	Wood for charcoal and distillation	Fuelwood			All other wood
		Total	Soft wood	Hard wood							Total	Soft wood	Hard wood	
AFRICA:														
Eritrea	1950	25	—	25	2	—	—	—	—	7	16	—	16	—
Ethiopia	1949	.	57	...	40	...	...	.	..	20	..	19	..	...
Somalia	1950	133	.	...	...	...	...	...	.	...	...	. .	.	...
Somaliland, British	1949	7	..	7	. .	...	...	...	.	..	7		7	...
Sudan	1949	405	...	405	15	...	.	..	[1] 3	[1] 256	[1] 131		[1] 131	...
ASIA:														
Cyprus [3]	1950	40	28	12	10	—	..	...	2	1	27	17	10	
Iran	1950	311	.	311	44		11	10		70	136		136	40
Iraq	1949	95	—	95	1		—		6	80	8	.	8	—
Jordan	1950/1	36	3	33	2		—	—		14	20	1	19	1
Lebanon	1950	34	. .	. .	. .	.	. .	...	..	..	. .	. .	. .	. .
Pakistan 4	1950	1 304	151	1 153	197		—	8	98	22	976	62	914	2
Turkey	1950	6,106	471	195	474	68	86	15	24	150	5 202	..	..	22

[1] Department of Forestry data only.
[2] Production for export and commercial sale only.
[3] Excludes wood taken from trees outside the forest.
[4] Includes both West and East Pakistan.

... Not available.
— None.
( ) Country totals know to be incomplete.

Source: FAO Yearbook of Forest Products Statistics 1951.

The tables above, and those in page 106, should be taken for background material to this article as a whole, and especially when studied in conjunction with the map in page 105. The tragically low output of timber and forest products is made the more clear when Tables 3 and 4 are compared, for example, with the areas of the various countries as given in Table 1.

pinea which was introduced centuries ago but has never established itself naturally and is mainly found in lowland plantations. The main broadleaved high forest species are *Platanus orientalis, Alnus orientalis* — both only found in moist valley bottoms, and several species of *Eucalyptus,* which are confined to lowland plantations. Other hardwood species occurring mainly outside the State forests are *Populus nigra, Juglans regia* and *Quercus lusitanica* while understory species are represented by *Quercus alnifolia, Q. coccifera, Pistacia terebinthus, Acer obtusifolia, Ceratonia siliqua, Olea europea, Juniperus phoenicia,* and *Acacia cyanophylla.*

After centuries of destructive exploitation, Cyprus had, in 1870, during the Turkish occupation, forest regulations providing restrictions on felling — hardly effectively applied — and orders prohibiting the export of timber. By the time of the British occupation in 1878, the forests which had escaped complete extinction were in a most deplorable condition, for besides cutting, clearing, burning and grazing, extensive damage had been done by a destructive system of resin-tapping and pitch-burning. The urgency of saving the remaining forests was so apparent that a Forest Service was immediately set up; the first Forest Law was enacted in 1879, followed by others in 1881 and 1898. The first years were devoted to forest definition and demarcation and to the application of forest protection.

Forest Protection Problems

This was most unpopular as was only to be expected since the forests had traditionally been a no-mans-land for all to exploit or despoil for their personal profit without hindrance. Malicious firing of the forests was therefore adopted by the villages as a form of expressing their disapproval for the new restrictions. This, in addition to the customary firing to produce better browsing within reach of the goat flocks or to produce fuel for the markets, reduced the forests to a very poor condition.

The beginning of the century saw the Forest Service firmly established: the forest boundaries had been surveyed, some forest stations had been erected and some lowland afforestation projects started. None the less, forest protection still lagged behind and all early attempts to check the destruction of the natural forests were met by a wave of incendiarism from the villages. In 1912 practically the whole of Kantara forest, an area of about 6,500 ha., was thus destroyed. The 1920s saw the application of scientific forestry by trained staff. From then until the late 1930s, was a time of anxious waiting and building up the Forest Service to a state of efficiency and development from which it could gain control of the forests and settle down to the effective application of protection and development. In 1931 a start was made on examining the whole situation systematically. It thus became evident that systematic exploitation on the basis of sustained yield, coupled with an extensive afforestation program, would provide more employment and so create alternative livelihood for those whose occupation was normally directed at forest destruction, as for example the graziers or others who preyed on the forests in order to gain a minimum subsistence livelihood. By 1938 local circumstances had so changed that effective forest development was at last [illegible] and the work was directed at diagnosing and r[illegible] the basic causes of forest destruction within the framework of amicable relations with all concerned. Within the next ten years practically all the mountain forests had been cleared of forest grazing, and large scale afforestation became possible for the first time. In 1939 the obsolete forest laws were brought up-to-date and consolidated into an effective legal background to this new situation. The 1939-45 war period caused urgent demands for excessive fellings, but the Forest Service was able so to control the cut that no silvicultural damage was done. On the contrary, the war period coincided with an extensive forest development plan which provoked intense activity and employment in the forests and the forests emerged from the war in a better condition than ever before and well on the road to recovery.

Long Term Policy

A written declaration of the long-term forest policy was finally drawn up by the Government in 1950. Its main features are:

(1) the direct benefits of forestry as a source of supply of forest produce are to a great extent surpassed by its indirect benefits in protecting catchment areas and controlling soil erosion, and it is therefore intended to extend reservation to all high level catchment areas and other lands and not to confine it to forests producing a direct economic return.

(2) In order to ensure that forest lands so reserved may fulfill their purpose of water conservation, including control of run-off and protection of the soil, it is deemed desirable to bring the vegetative ground cover to the maximum natural density, to free it from risk of injury by men and stock, and where necessary, to undertake field engineering works. To relieve pressure on local forests for timber supplies, considerable imports of timber will be needed, and particularly for fuel the aim should be to provide for the use of alternative fuels such as oil and coal and to develop electric power sufficiently to relieve the forests of all industrial and of most urban demands. In addition the intention is to create village fuel areas to provide sound timber as well as fuel wherever possible, and to encourage the planting of trees on village lands.

(3) Protection forests must be managed under a silvicultural system that does not at any time expose the soil to the dangers of erosion, and all forests under a working plan embodying the principle of sustained yield.

(4) In order to discourage depredations, the needs of the villages within or near the forests ought to be recognized and satisfied; where it is necessary to restrict grazing privileges, reasonable compensation or alternative means of substistence should be provided and even the voluntary removal of isolated villages with insufficient cultivable land to new sites outside the forest should be envisaged.

(5) Efficient management of private forests is to be promoted, principally by giving advisory services, but the imposition of control measures may have to be contemplated where necessary to prevent the deterioration of private forests through neglect or incompetence.

The Forest Service is under the direction of the Conservator of Forests who is responsible for all forestry work within the island; it consists of four territorial divisions and one working-plans division.

The field staff is composed of 7 professional foresters, 2 forest assistants and 150 permanent rangers and forest guards. Its financial resources derive from annual, ordinary and development budgets authorized by the Government. There is statutory provision for the protection and control of private woodlands by the government at the request of the owners; fourteen private forest properties totalling over 1,000 ha. are under this protection.

Approximately 60 percent of the denuded areas in the State forests which are subject to erosion have been treated by "gradoni", gully plugging or contour strip cultivation prior to seeding with forest species. An effective system of fire control is in force. The efficacy of the general patrolling against illicit cutting and grazing is computed at 70 percent. Utilization operations are efficient but are carried out on a small scale only; some improvement in the quality of the products could be achieved by capital improvements to the sawmills and woodworking machinery. The island has practically no export trade in timber and timber products; its import trade, which greatly exceeds production in volume, is confined to Europe.

There are no local facilities for higher forestry education in Cyprus and training of professional staff takes place in the United Kingdom. A Forestry College for the training of forest rangers was opened in 1951, where the full course lasts two years. (See *News of the World*, p. xx).

Iran

Iran has about 19 million ha. of forest, 11.5 percent of its total area, but a great part has been badly damaged to produce charcoal and fuelwood, and by overgrazing. The country consists of an ancient primary plateau which has undergone alpine folding (Elburz and Zagros mountains) and of quaternary alluvial deposits (plains of the Caspian Sea and Persian Gulf). The climate is of a dry-continental character, except in the Caspian region which enjoys a very heavy rainfall. The following table gives an idea of the striking differences in rainfall and temperature in Iran.

Locality	Rainfall mm.	Temperature minimum °C	Temperature maximum °C
Resht (Caspian region)	1,500-2,000	— 10	+ 25
Tabriz (N-W)	500	— 40	+ 25
Meshid (East)	400	— 35	+ 35
Tehran	300	— 30	+ 40
Ahwaz-Abadan (S-W)	200	+ 5	+ 55

Forest vegetation is naturally conditioned by the topography and climate, but in Iran centuries of destruction by grazing beasts, and by man for timber and fuel, have pushed the forests off the plains and valleys. Erosion has followed in many areas especially shifting the soil from the mountains down to the plains. There is evidence in Khuzistan that practically all that province has been covered by the deposit of silt from the mountains to the north. The shores of the Persian Gulf have, for example, thus been pushed back a distance of about 250 km.

The final result is, on the one hand, the creation of a water problem — as too little of the rainfall now percolates into the underground supply in the denuded hills — and, on the other, the uneven distribution of the forest vegetation which is now only found in inaccessible areas or where growth is rapid enough to maintain trees on cut-over areas that are not cultivated.

Existing Types of Forest

The existing forests vary greatly in value and belong to many different types, from the dense forests on the northern slopes of the Elburz Mountains to the completely denuded steppes which serve only as grazing land for sheep. Between these two extremes come all the intermediate types of degraded forests of approximately steppe-like character. Broadly speaking it is possible to distinguish three main forest regions: the northern slopes of the Elburz mountains; the west-south-western zone; and the Persian Gulf zone. There are in addition some isolated stands of wild pistachio trees in the east along the Afghan frontier.

With regard to the first, where there are roughly 4 million ha. covered with forest, some of which have never been cut because they are too far from roads, the main species are the following:

> *Acer campestre* and *A. platanoides, Alnus glutinosa, Carpinus betulus, Cupressus sempervirens, Fagus silvatica, Fraxinus excelsior, Gleditschia caspica, Juglans regia, Morus indica, M. alba, M. nigra, Parrotia persica, Platanus orientalis, Pterocarya fraxinifolia, Quercus castaneifolia, Q. iberica, Q. sessiliflora, Salix* spp., *Ulmus campestris, U. montana, Zelkova crenata.* The principal associations are made up of *Quercus castaneifolia*, unfortunately over-exploited and whose reproduction has been endangered by grazing; *Parrotia persica*, typical species of the region; and *Fagus silvatica*, which is very common. *Alnus, Salix*, and *Fraxinus* are usually found in humid valleys, while *Cupressus* is found on calcareous sites and *Buxus* invades forests badly overcut for charcoal manufacture. In cultivated groves are found *Juglans regia*, which supplies timber for the export trade, *Morus* for raising silkworms (only on the coast), and citrus trees in the Ramsar and Shasavar districts.

In the west-south--western zone are found

> *Diospyros kaki* and *D. lotus, Robinia pseudo-acacia, Ailanthus glandulosa, Melia azedarach, Myrtus communis, Pistacia terebinthus, Populus alba, P. euphratica, P. nigra*, and in particular *Quercus persica*. This species does well in spite of the great summer drought, either as coppice or pollard.

Finally, in this zone, as in the whole of Iran, there are many village irrigated plantations of poplar, plane, willow and ash.

The Persian Gulf zone is of a very different character, comprising both desert and sub-tropical regions.

> The most common species are *Melia indica, Mangifera indica, Phoenix dactilifera* (date palm), *Zizyphus* spp. which are also found in the second zone, *Tamarix, Acacia arabica* and *Albizzia lebbek*. There are no real forests worth the name.

When speaking of wood utilization, it must be borne in mind that statistical-records of controlled production tell only some of the story; there is a vast amount of

This desolate and eroded mountain scenery is typical of much of the so-called forest land in the Middle East. The scene above is in one of the forests of oak (Quercus infectoria) *in the Kurdistan area of Iraq; the pollarded appearance of the trees, however, will be more familiar to Western foresters especially than is the terrain, bare, eroded and, in the foreground, devoid of any apparent under-storey of shrubs or vegetation, although this is one of the better forest areas in the country.*

illicit felling and removal of wood especially for fuel, consumption of which is enormous. Industrial timber is obtained exclusively from the forests in the north and consists chiefly of walnut, oak, maple, alder and plane. The only woods exported, on a very limited scale, are walnut for veneers and *Quercus castaneifolia* for barrels; these are sold in the European market, mainly shipped from Khorramshahr on the Persian Gulf. The wood used in the country for joinery and framework is mostly beech, with plane next. Railway sleepers are made of beech and oak but the latter is becoming scarce. There is also a big home market for poplar raised in plantations, particularly in the towns. Extraction is by pack animal only.

Wood industries are still at the artisan stage. The biggest sawmill has a capacity of 30 m^3 per day, while the others are only workshops containing in most cases only two ribbon saws and one planer. The usual mode of business is to hire out the machines by the hour to customers who bring their own timber. There is a wood preservation plant in the Caspian region while match-making factories are found in Tehran, Tabriz and Isfahan. There are several paperboard mills using paper waste and straw and a plywood plant is in course of reconstruction.

Considerable confusion exists as to ownership of forest land. In the Caspian region, more than one-half of the forest is said to be the subject of dispute, the remainder being claimed by the State. This state of affairs naturally constitutes a strong incentive to over-exploitation.

The Forest Administration was formed barely ten years ago and consists of approximately a thousand men who control the forests on the Caspian slopes and some pistachio stands in the East. No declaration of forest policy has so far been made and there is no forest legislation. Education and training facilities for professional staffs are meagre.

Iraq *

Most of Iraq (43,542,000 ha.) falls within the 100-200 mm. rainfall belt, which indicates the types of forest vegetation that can be expected. The usual effects of shifting cultivation as practised in the Middle East, fires, excessive grazing by sheep and goats, and overcutting, combined with the unfavorable ecological conditions, explain why there are now under 2 million ha. of forest cover. Forest cover is again a generous expression, embracing the "souvenirs" of the past and hopes for the future.

The remaining natural forests are situated in the northern and north-eastern mountainous parts of the country and in the narrow flood plains of the great rivers. The mountain forests (*Ghabat*) are remarkably uniform in character and may be classified broadly into oak forest, pine forest, and mountain riverain forest. The first consists mainly of low oak scrub, generally poorly and badly degraded; in many places the vegetative cover has been entirely destroyed and

* See also *Forestry in Iraq*. G. W. Chapman. *Unasylva*, Vol. II, No. 5.

Poplars have succeeded well in parts of Iraq, and the left hand photograph above shows poles of this timber being transported, on a reasonably good road, near Shaglawa. The right hand photograph is of part of the Aleppo pine (P. haleppensis) *forest at Zawita... one of the few areas under conifers in the whole of the country.*

serious erosion has taken place. Within the oak forest community, three distinct associations can be recognized: from 450 to 750 m. mostly *Quercus aegilops* with *Pistacia khinjuk;* from 750 to 1,200 m. predominantly of *Quercus aegilops* and *Q. infectoria* with some subsidiary species; finally, *Q. infectoria* and *Q. libani* from 1,200 to 1,800 m., with *Pistacia mutica* and *Acer cinerascens.* Some of the best forests occur in this latter zone, for instance in the Kharadag north of Mosul, the forests north of Sirsing along the Turkish frontier, and in the region lying between Rawanduz and Sulaimaniya; trees of all age classes are represented with a fair amount of ground cover and often plenty of leaf litter.

The pine forest is found in a few limited patches in the Mosul Liwa, almost always on red marls; the species is *Pinus brutia,* which is almost invariably associated with *Q. aegilops* and *Juniperus oxycedrus.* The mountain riverain forest is an interesting type in which the chief species are *Platanus orientalis, Fraxinus rotundifolia, Salix acmophylla,* and *S. purpurea* . The woodlands, form narrow belts along valley bottoms and alongside streams; they have been despoiled of all valuable timber but would readily respond to protection. The same may be said of the oak forests which could also be rehabilitated in a fairly short time if properly protected. All the local species have, in fact, remarkable vigor and only need encouragement to recover.

In addition to the mountain forests there are the plains riverain forests or *Ahrash* which cover approximately 20,000 ha. and represent a fourth distinct ecological type. The main species is *Populus euphratica* with willow and tamarisk, but unfortunately the forest has been reduced to scrub by heavy cutting for fuel and brushwood. If protected, however, it could still recover.

To complete the picture, reference must be made to the poplar plantations (*Populus nigra*), which are a conspicuous feature of villages in most of the mountain valleys from 600 to 1,500 m. in the Mosul and Arbil Liwas, and to the 56 million date palms which provide a very considerable contribution to wood requirements.

Erosion and Flood Control

Soil conservation and flood control are of primary importance in Iraq. Leaving aside oil, the basis of the country's economy is agricultural prosperity which relies on the regulation of river flow. There is equal danger from too much or too little water in the rivers, and its quality is also of importance: excessive quantities of silt in suspension or too high a concentration of salt, eroded into the river from the drainage areas, impair its value for irrigation. The whole life of the Mesopotamian plain depends on the waters of the rivers Tigris and Euphrates, which originate in the northern mountains, the region of heavy winter rain and snow. Although much can be done by the construction of dams and storage reservoirs, ultimate control will be determined in the great catchment areas of the watersheds and in the rainfall zones of the northern plains. In the cultivated parts of the former, run-off after heavy rain can be controlled by terracing and other devices, but in the far greater uncultivated portion, this protection can only be afforded by natural vegetation. Considering that, in addition to the natural forests which are often in poor condition, there is at least an equal area of land once forested but now completely denuded, the seriousness of the problem is obvious.

Denudation and soil erosion in the hill country come from two main causes: shifting cultivation and vineyards on excessively steep unstable slopes. In the plains wind is the principal cause of erosion. Control of shifting cultivation and vineyards would involve the redistribution of rural populations and the establishment of an adequate system of shelterbelts and windbreaks in the plains. The solutions have been carefully considered by the Iraqi authorities, but all involve a great deal of money and time, and trained technical staffs.

Need for a Forest Law

An urgent need in the country is a strong and comprehensive Forest Law, the only present legal authority on forest matters being the Turkish Law of 1867. A 1943 Law for organizing the economic

life of the country — an extended wartime measure — provides power to control the issuing of felling licenses and the movement of forest produce, but the work of the Forestry Division (part of the Directorate-General of Agriculture under the Ministry of Economics) is seriously handicapped by lack of proper legal powers, apart from any declared forest policy, staff, and adequate funds. The financial resources of the Forestry Division depend on the year-to-year allocations to the budget of the Directorate-General of Agriculture.

As regards ownership, practically all the natural forests are state property according to the Land Code, but they are not yet specifically registered (only 50,000 ha. have so far been surveyed), and the State does not markedly exercise its right of ownership. The land on which it is proposed to establish shelterbelts in the plains is also state-owned but none of it has yet been allocated for this purpose. The only private woodlands of any importance are the quick-growing and irrigated poplar plantations in the mountain valleys to which reference has already been made; these are very profitable and the administration does not interfere in their management.

Research and Irrigation

Afforestation experiments which have been conducted in several places, sometimes with the aid of irrigation, indicate that there is no major difficulty in establishing suitable species, and there is no doubt as to the practicability of producing good timber from irrigated plantations on a sound commercial basis. A nursery has been established at Haji Omran, at about 1,800 m. altitude, to provide planting stock for afforesting the higher slopes of the mountains; the trees chosen, suitable for railway sleepers, are both Himalayan species, *Cedrus deodara* and *Pinus excelsa*. A large central forest nursery and experiment station is being established at Arbil, the headquarters of the Forest Division. Natural stands of *Pinus brutia* have been fenced to observe the effect on natural regeneration of closure to grazing.

Jordan

Out of a land area of 9 million ha., Jordan has only 0.4 percent under forest. These 35,000 ha. seem to represent, however, true forest, even though in a more or less degraded condition, and do not include all the areas with scattered trees or shrubs which are often classed as "forest" in Middle East countries.

There is a great difference between the existing forests in the east and west banks of the river Jordan. The former, in spite of past misuse, show signs of recovery as a result of protection during the past five or six years. Some of the oak forests, such as that of Wadi Sham, are very dense and the pine forests of Dibbin are regenerating remarkably well. On the west bank, there is no doubt that up to 1947 there were several good forest areas, but following the troubles of 1947-48, extensive areas of forest seem to have been completely cleared; even before then there was continual encroachment on reserved forest areas. Browsing by goats has checked regeneration and now the refugees from Palestine have further complicated the situation by lopping trees and even grubbing up the vegetation by the roots, creating a serious erosion problem.

The main types of forest vegetation in Jordan are as follows:

(1) *Oak forest.* The principal species is *Quercus coccifera*, often making up 75 percent of the growing stock, in association with *Pistacia terebinthus, Crataegus azarolus, Arbutus andrachne, Pyrus syriaca, Prunus* spp., *Styrax officinalis, Rhamnus* spp., *Olea*, and *Rhus* spp. When the cover is dense there is little or no undergrowth, but where it is open *Poterim spinosum* and locally (as at Wadi Sham) *Phlomis viscosa* occur, with *Echium* and *Onosma* spp. *Q. infectoria* is often present and sometimes forms an appreciable element in the Ajloon and Wadi Sham forests, especially on the escarpment at 750-1,100 m. with a rainfall of 600-700 mm. The parent rock in this type is always limestone. *Q. aegilops* comes in towards the north on the top of the escarpment, as in Juffain forest, where it occurs pure but with trees widely spaced. The carob (*Ceratonia siliqua*) also occurs in the oak association on both the east and west bank of the Jordan but sparingly and only where frost is not severe. This type probably covered all the mountains of Jordan to a greater or less degree until forty or fifty years ago, and it is still to be found in the extreme south near Shanbek up to 1,700 m. but with few associates except *Pistacia* and *Crataegus*. On the west bank *Pistacia lentiscus* and *P. atlantica* are the more frequent associates.

(2) *Pine forest.* This type is confined to a limited area around Ajloon. *Pinus halepensis* predominates with a sparse underwood of *Quercus coccifera, Arbutus andrachne* and less commonly *Pistacia terebinthus* and *Crataegus azarolus*, with *Cistus villosus* and *C. salvifolia* common in the undergrowth and *Poterium* in the open. Regeneration of pine is abundant, often profuse. This association occurs in the north only, on limestone at 750-900 m., where the rainfall is about 600-800 mm.

(3) *Juniper forest.* This type occurs on sand-stone south of Tafileh for some 30-40 km., as far as and beyond Shanbek on the steep westerly escarpment above the Wadi Araba at 900-1,200 m., with a rainfall of about 400-500 mm. A few ancient *Cupressus sempervirens* occur in this association and the species may have had a more extensive distribution in olden times. The endemic shrub *Daphne linearifolia* comes in this type on the Sharah plateau at 1,400-1,600 m. and extends towards Petra. Two species of *Astragalus*, a *Phlomis* and *Poterium spinosum* are the principal constituents of the ground flora, together with *Origanum* sp., and many other herbs.

(4) *Pistacia forest.* A few relict specimens of this occur here and there, clearly the remnants of more extensive forests but now forming scattered collections of trees, hardly amounting to an open crop. No associates occur, except *Retama raetum, Artemisia herba-alba* and *Atriplex* sp. in Wadi el Butum, and often there is little perennial vegetation of any kind.

Good progress is being made in the demarcation and survey of reserved forests on the east bank, in what was formerly known as Transjordan; practically all such forests are situated in the northern districts but settlement has also started in the south. This work should be started in the west bank without delay in order to check further damage by illicit cutting and over-grazing and prevent squatters from securing proprietary rights in what is correctly government-

owned forest land. A fairly large area of forest land, or land which could be afforested, is in private hands; a considerable proportion of this is merely low-grade grazing land for goats, and is generally a wasting asset if not a focus of soil erosion. Such land should therefore be afforested either because it is desirable on the grounds of soil conservancy or because it is the most appropriate form of land utilization.

No written declaration of forest policy exists in Jordan, other than the Forest Act of 1926. A revised draft was prepared in 1940 but this has not yet been enacted. As a matter of fact, the 1926 Act is quite satisfactory: what is, however, extremely important is that it should be extended to the forests of the west bank. A Goat Law drafted on the lines of the Cyprus Goat Law is under consideration. If enacted, it would be a great step forward and would constitute a potent weapon with which to combat the acute and widespread evil of free-range goat grazing.

Some first-class conservation work is being done in Jordan, mostly in the north but also at Karak and at Wadi el Kuf on the west bank. The technique is in all cases very similar and consists of "gradoni" work, strip cultivation and direct seeding or planting, according to site condition, with *Acacia cyanophylla*, which is very promising, cypress, *Pinus brutia*, *P. pinea*, almond, *Quercus aegilops* and *Robinia*. Some of the areas have been extremely successful.

There is no clear differentiation in this country between afforestation for production and afforestation mainly for soil conservation. In most cases planting serves primarily as a soil conservation measure and has only at its secondary purpose the production of either timber or fuelwood. The plantations at Samu and Wadi el Kuf, however, fall into the category of productive plantations. The former is quite remarkable: started a couple of years ago, in spite of some local opposition, acacia, cypress and pine were sown and planted in pockets of soil on a low limestone plateau and it is now most promising. The Wadi el Kuf plantation of 80 ha. was started about 1923 and planted mainly with *Pinus halepensis* and, on a small experimental scale, with *P. pinea*, *P. canariensis*, three cypresses and two acacias. The Aleppo pine is outstanding but the whole plantation is a magnificient piece of forest and demonstrates what could be achieved the country over and what it would look like if properly afforested. Trees along the valley have attained 15 m. in height and 40 cm. in diameter in less than 30 years.

Generally speaking, great progress has been made with afforestation in Jordan during the past three or four years, but much still remains to be done. Sufficient knowledge has been obtained as to the suitability of species, apart from the extreme south near Tafileh and Shanbek where it is felt that cypress will give good results and even cedar might be tried above 1,400 m. One of the reasons for the success achieved is the high standard of work in the 5 nurseries, which are well stocked with strong and healthy plants.

Poplar plantations along valley streams have great possibilities, but besides using *Populus nigra*, other species or types of faster growth should be tried. Farm forestry deserves to be more widely practised and efforts should be made to popularize it among the peasantry, either in the form of farm woodlots, windbreaks or even shelterbelts. Good examples of woodlots may be seen at Jubaiha near Amman where 18 ha. have been planted by the Forest Department with robinia, cedar and *Pinus brutia* on private land, to afford protection to the soil and shelter to a pear orchard lying below; and at Yamun village close to Jenin on the west bank, where the District Commissioner got the villagers to plant 12,000 trees on an Arbor Day.

The Forest Department under the Ministry of Finance has at present a very limited staff, consisting of the Director of Forestry located at Amman, 6 Forest officers and 161 forest guards. No forestry education is provided in the country itself but a few students are trained abroad, notably at the Cyprus Forest College.

Lebanon *

The land area of Lebanon covers around one million ha. comprising the Coastal Plain, the Coastal mountain range proper, the Upland Valley of the Beqaa and the western slopes of the Anti-Lebanon range and Mount Hermon.

Compact, very permeable limestones and sandstones are the characteristic geological formations. If slopes were covered by vegetation, this feature would have the utmost significance in a country of low and unevenly distributed rainfall, most of which tends to be lost by run-off. Both limestones and sandstones and the soils derived from them are sensitive to weathering and erosion, and this accounts for much of the rugged and severe scenery of the Lebanon. The rock formations near the coast are harder than those further inland, the heavier rainfall favors vegetation and erosion is less severe.

The country has a true Mediterranean climate: practically the whole of the Lebanon proper receives a fair average of rain, from 600 mm. to over 1,000 mm. per year on the highest slopes which rise to 3,100 meters. There is, however, great variation from year to year and most of the rainfall comes from November to February. The Anti-Lebanon range, however, has only 200 to 600 mm.; the Beqaa valley and the Coastal Plain have abundant springs. As a whole, the country contains a wide range of climatic variations from the typical humidity of the Coastal Plain through the Coastal mountain regions, down through the more sheltered valley of the Beqaa to the relatively dry heat of the Anti-Lebanon.

There is practically no part of the country where tree growth is inhibited by climate, but the western slopes of the Lebanon coastal range are by far the best for forestry; the western slopes of Mount Hermon are similar to those of the Lebanon proper and require similar treatment. On the Coastal Plain and the Beqaa valley, forestry is concerned only with the establishment of plantations and with what is known generally as "farm forestry" to provide shelter, timber and fuel.

* See also *Forest Conditions in Syria and Lebanon.* J. Rolley. *Unasylva*, Vol. II, No. 2.

Unlike much of Middle East, the Lebanon has some fine coniferous forests, of which the stone pine (P. pinea) *forests near Beirut are outstanding... a view in this area is seen on the right, above. The left hand photograph shows a part of the* Abies cilicica *forest near Kamouan, in one of the most interesting areas of natural forest left in this country.*

Ancient Forest Areas

There is plenty of evidence on the extent of the forests in the past, roughly 250,000 hectares. There is even a rock inscription at Mneitre which announces the existence of the private forest of a Roman Emperor and warns people not to touch it. But indiscriminate felling, burning, the browsing of goats and other animals, combined with faulty agricultural practices, have virtually exterminated the natural forest and degraded the soil which supported it. Today only 74,000 hectares of forest remain and the term "forest" must be liberally interpreted. 45,400 ha. are government-owned, 16,400 ha. privately owned, and 12,200 ha. owned by communities.

Two interesting forest areas occur in the northern part of the country on the foothills overlooking the plain of Tell Kalak, between elevations of 400 and 1,400 m., the Akkar and the Dennieh. In the Akkar, as the altitude increases, one finds first coppice of *Quercus coccifera* mixed with some *Pinus halepensis*, then coppice of deciduous oaks, and then at about 1,200 m. almost pure stands of *Abies cilicica* and lastly a very open stand of *Juniperus*, as the tree line is approached at 1,800 m. Within the Akkar, comprising approximately 8,000 ha. of forest, the forest of Jebel Amona deserves special mention; here is a pure stand of well-grown *Abies cilicica*, reproducing quite satisfactorily, and practically intact because of inaccessibility. Many of the trees are more than 2 m. in diameter and 30 m. in height.

The Dennieh comprises some good mixed stands of fir and cedar and occasional plots of pure cedar. Unfortunately, these are often mistreated and lopped.

The forests of Hermel and Baalbeck stretch over the eastern slopes of the Lebanon proper, prolonging the Akkar and covering a total of 35,000 ha., 5,000 of which is in the Anti-Lebanon. They consist of degraded coppice of evergreen oak, very open, overcut and heavily grazed and therefore bound eventually to disappear.

To the east of Tripoli, there are limited stands of cedar. Amongst the most interesting is the forest of Ehden also close to the spring of the Kadischa, which is the famous Cedar of Lebanon grove; located in a barren small valley at an elevation of 1,600 meters, this grove consists now of only a few trees but nearly all measure more than 3 m. in diameter.

Further south, the valley of the Nahr Ibrahim holds a stand of almost pure *Pinus halepensis*, and a vigorous forest of *Juniperus* occurs near the headwaters of the river up to 2,000 m.

The hill country near Beirut is fairly well wooded by plantations of *Pinus pinea* established in 1860. Privately owned, they are well tended to yield edible seed, industrial wood, and fuel wood.

In the Jebel Borouk and on the southern frontier there are degraded oak coppice areas and a few forest relicts. In the south, even the goat droppings are, in fact, assiduously harvested and transported by sea to Beirut and Tripoli to be used as fertilizer in the orange and banana plantations along the coast.

The distribution of the forest species may be summarized as follows:

Sea level to 1,600 m.:

— evergreen oak with evergreen underwood, junipers, *Pistacia lentiscus*, *Arbutus*, and *Myrtus*. Scattered wild olive and carob. When preserved from cutting and lopping, this type develops into forest of about 12 m. in height;

— *Pinus pinea* and *P. halepensis*. Easily raised in plantations, the former are pruned for crown development to stimulate edible seed production. Sandstone soils preferred; height up to 20 m.;

— deciduous oak: there are many species, some of which have economic importance for special products. Height growth up to 15 m.;

— narrow belts of plane, alder, walnut, willow, poplar along stream beds and in humid gorges.

Above 1,600 m.:

— cypress and juniper, sometimes associated with *Pinus halepensis* on lower levels. Cypress occur on calcareous and very dry soil, while juniper appears to prefer sandstones. Height up to about 25 m.

Above this level forests of firs and cedars begin, presumably once the main climax type of the Lebanon, with associated cypress and juniper.

It is estimated that about half of the forest area consists of oaks, mainly *Quercus coccifera* and then decidous oaks like *Q. aegilops*, *Q. cerris*, and *Q. libani*. Conifers come second, the order of importance

Within recent years, forest research stations and nurseries have begun to appear in the Middle Eastern countries. Above, left, is an avenue of poplars at Caradj School of Agriculture, Iran, shows a variety of types... fastigiate on the left, semi-erect on the right... all doing well. Below is seen the nursery at the experimental farm near Baghdad, Iraq. The upper right hand photograph shows poplars again, in this instance a plantation near Arne in Syria, where certain strains do well and are highly prized.

being *Pinus halepensis, P. pinea, P. laricio, Abies cilicica,* juniper, cedar, cypress. Secondary species such as walnut, maple, poplar, arbutus and pistachio and semi-forest trees like willow, fig, laurel, almond and olive occur over the rest of the area.

A Recent Forest Code

With regard to legislation, the Forest Code of 7 January 1949 placed some restrictions on all Lebanese forests. Clearing and cutting are subject to special laws, and can only be carried out when authorized by the Forest Administration after investigation. Clearing of privately-owned forests is only authorized on condition that the owner has irrigation facilities and replaces the forest by an orchard; the work must be carried out under the supervision of the Forest Administration. Only those trees not considered to constitute real forest types (eucalypts, plane, poplar, walnut, willow, alder, etc.) are exempted from these formalities which are intended to rationalize methods of utilization and ensure the conservation of the forest and soil.

Private forests are generally very small (the average is 5 ha.) and are managed by the owners themselves, under the supervision of the Forest Administration; their main produce is wood for fuel and agricultural purposes.

The efforts of Lebanese foresters are concentrated on the afforestation of 150,000 ha. of bare land considered to be suitable for forestry. Four forest nurseries have been recently established, capable of producing more than one million conifer and 500,000 hardwood seedlings. Afforestation by direct seedling of suitable species is also contemplated.

Torrent control is of great importance and serious floods are in fact sometimes occasioned by torrential rains. Control works are, however, only just beginning. Reclamation of marshy areas in the coastal plain has been fairly extensive, mainly by establishing eucalypt plantations. It is proposed to use poplar in the high plateau of the Beqaa where experiments have already given very promising results.

There are at present several projects under way for re-organizing the administration and management of the government and communal forests; for study of forest pests and diseases and for the prevention and control of forest fires. The main obstacle to the maintenance and regeneration of the forest proper is excessive grazing by herds of goats, coupled with unauthorized cutting, since the dense population is very badly in need of wood for fuel and other purposes. Vigorous administrative measures have been taken to counter these abuses and a new law on grazing in the forest and on forest exploitation has been passed. Afforested areas will be constituted as reserves and grazing land segregated; grazing within the forest, whether owned by the government, communities, or individuals, will be limited.

Logging and transport are generally done by ox and motor truck. There is little wood industry of any note but there are, nevertheless, 74 small sawmills and box-making factories and 8 veneer-making plants. The principal forest product is fuel, obtained from *Quercus coccifera, Q. aegilops, Q. cerris,* plane, poplar, *Pinus halepensis P. pinea and juniper.* The se[illegible] *Pinus pinea,* besides being used locally, is also [illegible]ported.

The timber trade is governed by very strict regulations: all wood comes under the control of the Forest Administration and cannot be removed without special permission, including the wood of non-forest species. The national output of timber is not sufficient to cover the country's needs. Exports are forbidden while imports are unrestricted; about 30,000 tons are imported annually, one-sixth consisting of wood for fuel.

The Forest Administration includes a Central Office in the Ministry of Agriculture at Beirut and the following services: 1) Afforestation and Soil Rehabilitation; 2) Forest Utilization; 3) Forest Protection; 4) Hunting and Fishing. There is besides a local service in each of the four departments into which the country is divided, consisting of an engineer, an inspector, 6 non-commissioned officers and approximately 20 guards. The budget of the Forest Administration is included in the overall governmental budget, but it also derives income from fines imposed as penalties for infringement of the forest laws, and revenue of one-third of the value of the products obtained from exploiting communally-owned forests. No revenue is obtained from private owners.

A College of Agriculture was established over 6 years ago in Beirut where a course in silviculture is included: a special one-year forestry course is also to be started. Non-commissioned officers and forest guards are trained at present in the Departmental Schools of Agriculture.

A "Cedar Week" and "Arbor Day" are celebrated every year, and technical advice is given to private individuals wishing to undertake afforestation work. Should individual owners be unable to meet the cost, the government will carry out all work which is considered to be in the public interest. Part of the revenue derived from the forest thus created will in the future serve to reimburse the cost to the government.

The only merchantable timber comes from riparian species such as *Platanus orientalis, Juglans regia* and *Fraxinus rotundifolia* and from poplar plantations. Extraction is not greatly developed for either timber or charcoal, which is packed in sacks and loaded on mules and lorries. Domestic demand for all types of forest produce greatly exceeds supplies, despite imported material.

There are no institutions providing higher education in forestry but a few students go abroad for training.

Syria *

About 422,000 ha., 2.3 percent of Syria's total area, are considered as being under "forest".

The main topographical features of western Syria are the Jebel Ansariyah range rising to about 1,500 m. in a line of undulating highlands, the Ghab depression, and the eastern slopes of the Anti-Lebanon range and Mount Hermon. In eastern Syria are the steppes and desert wastes west and south of the River Euphrates, the volcanic region of the Jebel Druze and Hauran,

* See also *Forest Conditions in Syria and Lebanon.* J. Rolley. *Unasylva,* Vol. II, No. 2.

the Euphrates valley, and the Jezirah east of the Euphrates. Apart from the central depression and the coastal range, which receives the highest rainfall (over 1,000 mm.) and contains the main forest areas, the eastern plateau is the most extensive area; much of it is suitable only for pasturage but certain upland areas are of interest from the forestry point of view because of the remnants of forests of special type (mainly *Pistacia*), particularly adapted to extremely dry conditions. Generally speaking, there is a gradation through steppe, semi-desert and desert from west to east and north to south.

Rainfall varies accordingly and corresponds to that of similar localities in the Lebanon, with humidity on the coast and high precipitation of well over 1,000 mm. on the seaward slopes in the coastal plain and Jebel Ansariyah; these areas have a true Mediterranean climate. East of the Jebel Ansariyah the rainfall lessens, dropping to 600 mm. very quickly and further east to 300 mm., with some slight variation due to altitude in the Jebels.

Temperatures vary considerably, and the range is far wider on the plateau, where frost damage can be severe locally. Summer maxima on the plateau may be as much as 49° C.

Soils are mainly clay loams of limestone and marl origin, ranging from reddish brown to white in the desert. The subsoils derived from the basalt lava formations in the Jebel Druze area are particularly fertile. There has been serious erosion in the western rainfall belt, and (by wind) in the flat cultivated plains.

The "forest" land of Syria is mostly not covered by forests in the generally accepted sense but able to produce forests of some sort if properly protected. Of this area about 90 percent is owned by the state and the balance by private and communal owners. The state area has been reserved and although only roughly surveyed and not properly demarcated, it represents a good beginning.

The areas most suitable for forest growth are readily identifiable by the existing forest remnants. The most important localities are as follows:

(*a*) The forest region called Kurd-Dagh in the north, to the north-west of Aleppo. It is limited in extent and was practically ruined by uncontrolled cutting during World War I. Some coppices of *Quercus coccifera* remain, with occasional pines (*P. halepensis* and *nigra var. pallasiana*).

(*b*) The two forests of Baer and Bassit, covering a total area of about 25,000 ha. to the north-east of Latakia, and forming the principal forest block in the whole of Syria. The Bassit, close to the sea, is covered with fairly dense and almost pure stands of *P. halepensis*, which unfortunately suffer from fires; the Baer, at a higher altitude (800 m.), comprises *P. halepensis*, *Quercus cerris* and *Q. aegilops*, these two deciduous oaks regenerating freely. This forest area is, on the whole, undamaged, except round the perimeter where wood is cut for use in tobacco-drying plants.

(*c*) The Jebel Ansariyah is covered on its crests by fine commercial timber of deciduous oaks, with isolated trees of *Cedrus libani*, *Abies cilicica* and *Juniperus excelsa;* the approximate area is 20,000 ha.

The inland mountain ranges have been practically entirely deforested. Except for the date palm, *Pistacia kiniuck* is the only desert tree; is of special interest as, even in very difficult xerophytic conditions, it reaches 5 m. in height. Quite extensive areas of this species are found in two parts of the Syrian desert; there are only a few trees per hectare and there is no regeneration on account of browsing by goats and illicit felling. South of Damascus and Kuneitra, the vegetation consists mainly of dense, stunted scrub of various evergreen and deciduous oaks, very heavily browsed by goats.

The reserved forests are said to be made up of one-fifth evergreen oaks, one-fifth deciduous oaks, one-fifth conifers (*Juniperus excelsa, J. drupacea, Pinus halepensis*), another fifth of *Pistacia*, and the last fifth of other species. Among the trees commonly raised in irrigated plantations there is notably a local species of poplar known as *roomi*, the timber of which is highly prized. There are excellent orchards, groves and gardens in certain localities such as Damascus where 15,000 ha. of trees form a striking contrast to the surrounding desert. Some excellent studies in tree nursery work and in the selection of suitable species for special purposes have been made at various horticultural stations.

In 1930, under the French mandate, the Land Code replaced to a large extent the old Moslem Land Laws and the Ottoman Land Code. The most important category of land is *Miri* where the State retains the right of ownership while right of occupation is enjoyed by private individuals who can sell, mortgage and lease this right. Continuous cultivation is required, otherwise the land reverts to the State; this alone has caused much land abuse. Originally, the holder of *Miri* land could not change its character (e.g. by converting it to woodland), without special permission, but this is now altered. Communal ownership or *Masha* is prevalent in the East, and certainly encourages misuse of land, especially since the land periodically changes hands from one community to another

Present forest law is embodied in the Forest Code of 1935, with decrees issued from time to time; there is no written forest policy other than reference to certain principles in the Code mentioned above. In 1942 and in 1945 Goat Laws were introduced aiming at the exclusion of goats from forests and orchards.

Domestic demand for timber and fuel is very far from being met, despite high imports. The forests consequently suffer heavy damage from illicit felling, lopping, clearing, and burning for charcoal. Forest land is still being broken up for cultivation, even on steep slopes; this is permitted under a law which enables a man to claim the land as his own after he has cultivated it for ten years on permit. The soil lasts for about five years and then disappears completely. The rate, for example, at which high forest in the Selemiya area has disappeared in the last 20 years is startling; a few decades ago places where there is now not a tree or even a shrub to be seen carried well-stocked oak forests, including valuable species such as *Q. aegilops*. Fortunately the first counter-attack, the most difficult, has already been made by government reservation of an area of roughly 380,000 ha. Although a long rest will be required before even the best land begins to yield again, the forest does appear to possess remarkable powers of recovery when goats are excluded. It is hoped that official reservation will save the forest from destruction.

Turkey has many areas with fine stands of hardwoods, including especially various species of oak and beech. On the left above is a typical oak forest used also for grazing, at Haras de Caradjbey... the rich herbage contrasting strongly with the sparse ground cover seen in other photographs in these pages. On the right, a beech forest near Bolu in the Black Sea region has been invaded by rhododendrons, here as elsewhere a serious forest weed.

Grazing by sheep and goats remains, however, the chief and most difficult problem of the country. In state-owned forests, grazing is theoretically allowed only on permit and permits are not issued for forests less than 15 years old. There are rights of pasturage, but the numbers of animals are not specified and it is left to the discretion of the Forest Department to fix these numbers. This, besides being too great a responsibility for the department, does not solve the problem, because limitation of numbers of animals should go together with provision of alternative occupations for the herd owners. Grazing on so-called natural pastures or open rangeland also requires close attention since certainly not more than one-quarter of the area available can provide anything like permanent pastures; and it is extremely doubtful whether the total area can support the present goat and sheep population without more extensive irrigation than at present.

A separate Forest Department was created only in 1943 and until recently it consisted, besides the Director, of four "controllers", 25 "agents" and 84 forest guards. The work of the field staff overlaps in some respects that of the Agricultural Department; in some cases "controllers" have to supervise the local work of both Departments. There are said to be 5 well-run horticultural and forest nurseries at Damascus, Aleppo, and elsewhere, under the jurisdiction of the Agricultural Department, which provide seedlings for state planting and, on payment, for private owners.

Turkey

Turkey's total area, including inland waters, is around 77 1/2 million ha., of which about 13 percent (10,358,000 ha.) is under forest. The country comprises a wide central plateau surrounded by two mountain ranges running from east to west; to the north the Kuzey Anadolu Daglari stretching almost parallel to the Black Sea, and to the south the Toros Daglari describing a vast arc. Altitudes vary from sea level up to 3,900 m. in the vicinity of the northern frontier between Turkey and Russia, with peaks such as Mount Ararat (5,165 m.) overlooking all this rugged region. Turkey may thus be divided into the following seven natural regions: the Black Sea region, the Sea of Marmora region, the Aegean Sea region, the Mediterranean Sea region, and Central, Eastern and Southern Anatolia.

Of the total area considered as "forest", only one million hectares are covered with good high forest, and 2.5 million ha. with productive coppice (mainly oak); the rest consists of degraded high forest (more than 5 million hectares) and very poor coppice. Privately owned forests amount to only 30,000 ha.

Just over half the growing stock consists of conifers. For instance, in the upper parts of the Toros Daglari, the main species are *Cedrus libani, Abien nordmanniana, A. bornmulleriana, A. cilicica, A. equitroiani, Picea orientalis, Pinus silvestris, P. nigra, P. brutia,* and *P. pinea.* Hardwoods are *Fagus orientalis, Quercus sessiliflora, Q. pedunculata, Q. cerris, Q. aegilops, Liquidambar orientalis, Fraxinus ornus, F. oxycarpa, Alnus glutinosa,* and *A. barbata.* On southern slopes, the lower parts are covered with oak and the upper with pine; northern slopes support fir, beech and pine.

Elsewhere high forest mainly occurs on the mountain ranges which have a maritime climate, and the best forests have survived because they occur on very steep slopes difficult of access, as in the Black Sea coastal area. East of Trabzon there are almost inaccessible spruce forests (the forests of Artivire), and excellent forests of pine, fir, and beech extend over thousands of hectares on the mountain summits between Samsun and Zonguldak and in the districts of Kastamonu and Bolu. Some of these are virgin forests in that there has never been any systematic exploitation; the growing stock sometimes amounts to as much as 500-700 m^3 per ha.

The Marmora region no longer contains only oak coppice and some beech, capable of producing pitprops and sleepers, while first quality pine stands are still found on the highest slopes in the Aegean Sea region. The Mediterranean area supports the "maquis" proper to this region, but there are tracts of cedar and black pine chiefly useful for soil conservation. The black pine forest of Pozanti, located to the north of Adana, has an annual output of from 15 to 30 thousand m^3 of

Pinus nigra *in one form or another is one of the most frequent conifers in the Middle East, but this extensive forest of it near Smyrna, Turkey, has been severely degraded as a result of over-grazing. The grazing problem is indeed one of the cardinal difficulties of forestry throughout the region, and the effects of too many uncontrolled livestock are often much worse than those seen above. The photograph in the opposite page shows another typical Turkish conifer,* Abies bornmulleriana; *this forest is near Uludag.*

logs which are floated down the rivers to the sea. It is interesting to note that the forests in this area used to be worked for export timber for other countries of the Middle East, and that large scale fellings took place when the Suez canal was being built. The forests have never recovered from this exploitation.

The three zones of Anatolia have nothing left but degraded oakwoods, spoilt by grazing and misuse. The only exception is the very extensive pine forest of Akdgamadeni (roughly 100,000 ha.) situated in the middle of the uplands of Central Anatolia, which represents second-growth forest established after a fire.

State Control of Forests

The first regulations governing the forests of the Ottoman Empire were issued in 1868; in 1924 a law was passed establishing conditions for forest management; finally, in 1937 a Forest Law was promulgated which constituted a genuine forest code. From that time the Forest Administration has been entrusted with forest exploitation, from felling of the standing trees to the marketing of semi-finished products (logs, pitprops, pulpwood, sawnwood and fuelwood). Lastly, in 1944, all forests not yet owned by the government were nationalized, so that today all land classified as forest is subject to the forest law and administration, management, utilization and marketing of products are the concern of the Forest Administration. Areas afforested by private individuals form the only exception.

The main objectives of forest policy in Turkey now are:

(*a*) establishment and maintenance of forest cover on steep mountain slopes, to prevent erosion, help soil conservation, and regulate water-flow, especially to make surplus winter rainfall available for domestic needs and irrigation during the spring and summer seasons;

(*b*) maximum use of the forest for recreation purposes, to improve the look of the countryside and help tourism;

(*c*) maximum sustained yield of industrial wood and other forest products, and support of local wood-using industries;

(*d*) ensuring regular employment and certain privileges to the greatest possible number of forest workers living in villages adjacent to the forests, as a means of reducing damage from fire and illicit felling; and

(*e*) secure revenue for the government.

A new Forest Law to remedy weak points in the existing law and to help reach the above goals is now under study by the National Assembly.

The Forest Administration, which has its own budget, consists of a Central Office, under the Ministry of Agriculture, with a Director-General and a Deputy, directly responsible to Parliament, and a Field Staff. There is a body of technical advisers, within the Central Office, composed of a chairman, 4 permanent members and the Directors of the 13 divisions (management, inventory, afforestation, utilization, etc.) constituting the executive service. This technical council examines projects and submits proposals to the Director-General for final decision. The field staff is organized into 15 " conservations ", 85 " districts " (each controlling some 100,000 ha.) and 687 " cantonnements ", all directed by forest engineers. The Forest Administration, in existence since 1857 but effective only since 1923, also includes 11 " management commissions ", each consisting of a chief and four engineers; since 1924 these commissions have brought under management approximately 2.5 million ha. of forest. High forests are managed on the selection system.

It is worth mentioning that all villages which have no available woodlands must plant at least 5 ha. of trees, the planting stock being supplied free of charge by the government. For 1952-56 it is planned to afforest 10 hectares around each of some 250 villages in the Central Plateau of Anatolia, using Marshall Plan funds. To encourage private afforestation, technical plans are prepared without charge by Administration personnel and the areas planted are exempted from land-tax for 50 years, and the sale of produce from income-tax. Finally, the government bank grants 20 year loans at 1 percent interest.

The Forest Administration itself is concerned with the afforestation of marsh-land, the reforestation of gaps within existing forests, and any undertaking which requires artificial regeneration. Roughly 3,600 hectares of plantations have been formed so far by the Administration, including 1,200 ha. of eucalyptus and over 165 ha. of poplars, besides the sixteen nurseries have been set up covering a total area of 652 ha., the aim being to produce 12 million seedlings a year. Plants (usually 5 years old) are supplied free of charge, as has already been said, to villages and at one-fifth of cost price to private individuals. The plants raised are mostly of poplars for planting in the valleys.

Logs are generally conveyed to storage depots near roads or railways either by animals or Decauville railways, or by floating, and are then sold by auction. A small proportion is converted in the 7 state sawmills, 3 of which have a capacity of more than 20,000 m^3 per year. Selling prices of forest products are very high (although sometimes kept lower than cost prices) due to the fact that commercial exploitation of the forests is far from easy while the methods used are often outmoded. Wood can often be imported more cheaply than homegrown timber can be produced, so there are considerable imports. In 1949, for example, 13,000 m^3 of sawlogs and veneer logs, 142,000 m^3 of pitprops, 112,000 m^3 of lumber and 28,000 m^3 of pulpwood were imported, along with 6,000 tons of charcoal. This does not mean that Turkish forests are not heavily exploited. As a matter of fact the average production, controlled by the government, appears to exceed annual growth by approximately 3 million m^3. This, however, is not due so much to intentional overcutting as to the salvage and use of windfallen and

burned trees (forest fires being frequent). In addition to this, it is estimated that close to 9 million m³ of timber are illicitly cut every year.

Heavy cutting for timber is therefore one of the factors responsible for the present poor condition of the forests in Turkey, but not the only one. A second of great importance is the incapacity of the cultivated soil to feed a population which has increased by 38 percent in 18 years. Consequently there is an anxious search for new land on which to cultivate food crops and raise big herds of goats. On the shores of the Black Sea, for example, some cultivated fields are so steep that the peasants must tie themselves to trees in order to till the soil. This grave problem continues to receive the full attention of the Turkish authorities and all possible remedies have been envisaged, including the re-distribution of rural populations, the modernization of agricultural methods in the fertile areas in order to produce a substantial increase in production, and the building of dams to provide water for irrigation.

Education of foresters is provided in Turkey by the College of Forestry at the Istanbul University; this college was founded in 1857 but only become part of the University in 1948. After a 4-years course, students graduate as forest engineers and start their service with the Administration as chiefs of "cantonnement" under training. A school providing a course of 2 years for non-commissioned officers and forest guards is due to be inaugurated in 1952.

West Pakistan

From the climatic and vegetation aspects, West Pakistan has affinities with the Middle East while the eastern region pertains to South East Asia; only the former is therefore being considered in this summary.

West Pakistan covers a total area of about 80 million ha. and at a rough estimate the area under forest is approximately 1,700,000 ha.; much of the land classed as "forest" for administrative reasons does not in fact support any forest growth at all.

The climate has many extremes: from the arid rainless expanses to wet green valley; from many degrees below freezing in the hills to the blistering heat of the plains; from the sand dunes and gravelly desert to the water-logged swamps. These variations necessarily result in great differences in the vegetation and incidence of population. The distribution of forests in West Pakistan is therefore primarily a function of climate, strongly affected by human interference.

The existing forests may be divided into natural forests and artificial forests or plantations. The former cover about 400,000 ha. in the north and north-west mountain and sub-montane areas, about 565,000 ha. in the dry hills of Baluchistan and the tribal areas, some 485,000 ha. in the wet plains along valleys, and scattered dry areas of scrub in the plains of the Punjab which have escaped clearing mainly through lack of communications. The artificial forests or plantations are mostly confined to the Punjab, though they are being created in increasing number in Sind and in other provinces. These plantations have all been created in thickly populated plains and chiefly in connection with irrigation schemes as part of land reclamation projects.

Many Forest Types

The mountain forest type occurs from about 900 m. to 4,000 m. altitude. It consists mainly of conifers such as *Cedrus deodara, Pinus excelsa, Picea morinda, Abies* spp., and on hot southerly aspects and low altitude *Pinus longifolia*. Rainfall is highest (1,300 mm.) to the east of this belt and gradually decreases towards the west. The proportion of *Cedrus deodara*, which is the fost valuable tree, increases as rainfall lessens. The common broadleaved associates, depending upon altitude, exposure and rainfall, are *Quercus* spp., *Acer* spp., *Aesculus hippocastanum, Populus, Juglans, Salix, Betula*, and *Juniperus*.

The sub-montane type does not occur above 900 m. altitude. The climate is dry and temperature reaches extremes both in the hot and cold seasons. *Pinus longifolia* is found on upper reaches but the typical forest formations consist of *Acacia modesta, Olea cuspidata, Prosopis spicigera, Dodonaea viscosa* and *Zizuphus* supp.. *Ichimum angustifolium* and other grasses are profuse.

The Baluchistan hill type is found in very dry areas and is in an extremely poor state at present. *Pinus gerardiana* and *Juniperus macropoda* are the main species but there are others hardy and drought resistant. This type occurs from about 1,500 to 3,000 m. above sea-level.

Riverain forests, locally known as *bela* forests, are found along the big rivers in areas subject to annual inundation or seepage, particularly in Sind and the Punjab. The commonest species is *Acacia arabica*, which occurs extensively, while others are *Dalbergia sissoo, Prosopis spicigera, Populus euphratica, Butea, Salix*, and *Tamarix*.

The scrub forests or *rakhs* occur all over the Punjab plains and have remained undestroyed mainly because they are located at a great distance from centers of consumption. The species present are of a typical xerophytic character, such as *Prosopis spicigera, Salvadora oleoides, Dodonaea viscosa, Capparis* spp., *Acacia* spp., *Tamarix* spp., etc. Most of this area is not under the control of the Forest Department although more and more control is being gradually acquired.

The artificial forests or plantations have all been established by the Forest Department and now cover an area of approximately 40,000 ha. The main species planted so far are *Dalbergia sissoo, Acacia arabica, Melia azedarach, Eucalyptus* spp., *Prosopis* spp., etc.

As regards utilization, *Acacia arabica*, besides making excellent fuelwood, is used in the manufacture of carts, agricultural implements, tool handles, tent pegs and pitprops. *Acacia modesta* is also an excellent fuelwood and in addition is used for cart wheels, sugarcane crushers and agricultural implements. *Abies pindrow* for packing cases, shingles, railway sleepers (after creosoting). *Cedrus deodara* is an important structural timber and it is suitable for railway sleepers, carriage and wagon work, house-building, beams, floor boards, door and window frames, light furniture, shingles, ordnance boxes and pattern making. *Dal-*

Typical of much of the mountainous Middle East is this photograph, with its small area of cultivated hillside surrounded by eroded, shrub-covered slopes. Notice the contrast between the well-tended area on the right and the neglected part in the center and left, with crumbling terrace walls where erosion is once more gaining a destructive grip. The area in the background is similar to much that in these devastated lands is classed as "forest".

bergia sissoo is the finest wood for furniture, cabinets and carving and a good constructional timber for house-building and general joinery and carpentry work; it is extensively used for carts and carriages, agricultural implements and ordnance articles, and is also good as fuelwood. *Dodonaea viscosa* is a very good firewood species. *Juniperus macropoda* is an important pencil wood, also used locally as beams and rafters in hut building. *Melia azedarach* is suitable in small sizes for the manufacture of packing cases, cheap furniture and for rough roofing while it is not considered good for fuel owing to the pungent smell which it emits when burning. *Morus alba* gives a high quality wood for sports equipment such as hockey sticks, tennis, badminton and squash rackets; it is also used for camp furniture, picker arms and carriage building. *Olea cuspidata* is suitable for tool handles, turnery and carving work besides making good fuelwood. *Picea morinda* is used for planking for floors and ceiling, general cheap joinery and water throughs. *Pinus excelsa* is a well known joinery wood, suitable for constructional work, house fitments, light furniture, shingles, packing cases, cores of laminboards, drawing boards and planetables. *Pinus longifolia* is a popular building timber, particularly for roofing, flooring, shingles, etc.; it makes good railway sleepers after preservative treatment, and it is also suitable for transmission-poles and for the manufacture of matches. *Populus euphratica* is used for packing cases, match splints and match boxes, light domestic furniture, turnery goods and toys. *Prosopis spicigera* makes an excellent fuelwood. *Tamarix* spp. are used for agricultural implements and small household articles in villages.

The position with regard to the production of wood in West Pakistan is serious. In some places there is plenty of timber and fuelwood, in others none at all. The total output of timber is quite inadequate, and present consumption for the area as a whole is estimated to be 40 times less than what is considered to be the minimum requirement. The fuelwood situation is in particular very serious since there is no alternative fuel at all, either for domestic needs or for the industries which now depend upon wood fuel

This map of wood research establishments in Germany, drawn by the Institute of Wood Research, Brunswick-Kralenriede, indicates the way in which the stations are well distributed throughout the Federal Republic, while at the same time a number of institutes are grouped close to each important center. This of course makes for easier exchange of views and information between colleagues working on related problems, but at different institutes. The former state institute at Eberswalde is also shown in this map.

Research in the Federal Republic of Germany

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Forest Research

It is the tradition in Germany that scientific research work should be linked, whenever possible, with university studies. This explains why even today most forestry institutes in the Federal Republic are headed by scientists who are also university teachers. A course of study of a minimum of 8 semesters, leading to a forestry degree ("Diplom-Forstwirt"), can be followed at the universities of Freiburg-im-Breisgau, Göttingen (Hann.-Münden) and Munich. We shall first describe the operation of the forestry institutes of these three universities.

University Research Institute

University of Freiburg-im-Breisgau. The faculty of Natural Sciences and Mathematics here has a forestry section consisting of 8 institutes, covering:

Forest Botany,
Forest Zoology,
Soil Science,
Silviculture,
Forest Management and Economics,
Forest Yield and Wood Science, which incorporates the Baden Forestry Experiment Institute,
Forest Policy,
Forest History.

The Institute of Forest Management and Economics is at present primarily studying the improvement of the generally unsatisfactory farm wood lot productivity in Germany, on the basis of a survey made in 1946-51 in Baden. The following research projects are under way: on the relation between small farm forest management and the management of the farm itself; on the practicability of the beech selection system in farm wood lots; on the status of coppice and the possibility of its conversion into high forest; on problems of farm land and pastures in the Black Forest. The Director of the Institute of Forest Yield and Wood Science is also the head of the Baden Forestry Experiment Institute, where recently priority has been given to studies of differences in rate of growth of the main wood species in various types of forest. At the Institute of Forest Policy, the following research work is at present under way: reform of forest legislation; comparison of types of government assistance to private forest owners; development of forest management statistics and the bases for forest economy statistics; setting up of timber balances for the Federal domain. The Institute of Forest History considers the old established forest economy, the scientific basis of which was laid over 150 years ago, as a unique major experiment, the conditions, successes and failures of which it seeks to investigate in search of lessons for the present and future. An attempt is being made to determine the changes in species in individual forest areas in the course of history.

University of Göttingen. The Faculty of Forestry at Hann.-Münden has 10 research institutes, and, in addition, a "Training Center for Forest Work". The institutes cover:

Forest Botany and Mycology,
Soil Science,
Forest Zoology,
Hunting,
Pure Silviculture,
Applied Silviculture,
Forest Law and History,
Forest Policy and Economics,
Forest Management and Production,
Forest Utilization.

The Institute of Forest Botany and Mycology is at present studying the basic problems of forest genetics. At the Institute of Soil Science, since 1945, results have been achieved mainly in the matters of fertilizers, humus, and stand surveying and mapping. Plant sociology findings at the Institute of Pure Silviculture have been used particulary for the diagnosis of conditions and for planning. The head of the Institute of Applied Silviculture is also in charge of a 2,200 ha. demonstration forest in the Weserbergland, where on a 500 ha. plot an experiment on the transformation of extensive, even-aged high forest into mixed uneven-aged stands is under way. In the Institute, attention is focused on ecological conditions, economic pre-requisites and the effects upon the stand of type of treatment. The Institute of Forest Law and History is continuing its researches in the realm of forest history on the changes in tree species in the beach stands of northwest Germany, as well as on the evolution of forest land tenure and the forest police and ranger corps. In forest law, special research is being done on forest legislation and penal law.

The Director of the Institute of Forest Management and Scientific Production is also the head of Section A (Production Research) of the Forest Experiment Institute of Lower Saxony. The Institute is working out volume tables for individual trees and stands. The Section has under observation those experimental plots of the former Prussian Forest Research Institute at Eberswalde to which it still has access and parts of which have been the subject of accurate observation for 70 years. Particular stress has lately been laid on ascertaining and evaluating the properties of individual trees in these areas under various treatments, and on research into the structure, increment and biological characteristics of mixed stands. Section B of this Experiment Institute (Control of Forest Pests) in Sieber/Harz is not a university

stitute. At present, research is being conducted on the control of the larvae of *Melolontha vulgaris* and the large brown snout weevil, as well as on such pests as the oak-leaf roller and the small spruce sawfly. Special research is being done on infestation causes, prophylaxes and direct and indirect control measures. Work is also being done on the dieback of beech trees, with particular reference to the beech aphis and *Buprestidae*. A regular job of the Institute is the testing of insecticides. The Institute of Forest Utilization is investigating primarily the properties of unprocessed wood and the effect of climate, soil and forest treatment upon timber qualities and defects. Studies are also being made on quality changes between felling and processing. The Institute is also studying the expansion of Central European wood extraction techniques and the improvement of logging methods in permanent forests.

University of Munich

In the Department of National Economy of this University there is a Forest Research Section comprising 10 institutes covering the following subjects:

Forest Botany,
Forest Seed and Plant-breeding,
Soil and Habitat,
Applied Zoology,
Hunting,
Meteorology,
Silviculture,
Forest Economic Policy and Management,
Forest Yield,
Wood Science and Forest Utilization.

The Munich research establishments have not yet had war-damage completely restored so that research work is still greatly impeded. The Institute of Forest Botany is well known for its long and comprehensive study of tree-ring chronology in Central Europe. The Forest Seed and Plant-breeding Institute is concentrating on forest tree seed problems. The Soil and Habitat Institute devotes attention, in addition to soil science and ecological problems, to the systematic improvement of methods of surveying and to the organization of work in forest site determination, combining with work on geology, soil analysis, vegetation, and forest history. At the Meteorological Institute, valuable research has for years been carried out on the extent to which the microclimate is affected by silvicultural measures and on the specific weather conditions which may cause forest fires in Central Europe. The silviculture tradition at the University of Munich, which, since 1878, has become famous with the names of Carl Gayer, Heinrich Mayer and Ludwig Fabricius, molds the present and future work of the Institute of Silviculture. The latter is concerned mainly with problems of mixed stands, the intensification of forest care, forest sociology in the broader sense, and forest geography in the form of forest site surveys. In the scientific work on these problems, particular emphasis is laid on the review of practical silvicultural results. The Institute of Wood Science and Forest Utilization is primarily interested in biological research.

THE FEDERAL INSTITUTE AT REINBEK

As a result of World War II and its aftermath, all the Reich institutes dealing with the forestry and wood economy sectors were rendered ineffective and it was not until 1947 that the Federal Institute of Forest and Wood Economy was developed at Reinbek near Hamburg out of the former Reich Institute of Foreign and Colonial Forest Economy. It includes the Institutes of Forest Economy and of Wood Economy and Research, which are also branches of the University of Hamburg, where the Department of Mathematics and Natural Sciences offers an 8-semester course for foresters (this was given at Eberswalde up to 1945). In addition, there are at Reinbek post-graduate study facilities consisting of lectures, seminars and practical work in world forest economy and exploitation. The work of the Institute of Forest Economy, with its 5 research sections, is concentrated on the following subjects: analyses of the forest products economic situation in the world following World War II; evolving reliable scientific methods of analysis and forecast, especially for appraising the industrial potential of economic forest management units; technological and regeneration methods for reconstituting woodland and increasing production in existing commercial forests. Furthermore, it is one of the tasks of the Institute to evaluate foreign literature on silviculture and make it available to German foresters and to promote and strengthen ties with foreign forestry institutes.

The work of the Forest and Wood Economy Policy Section centers on the collection and processing of home and foreign statistical data and their compilation in documents, statistical card indices and a world forest atlas. Work is also being done on inventory procedures on a sampling basis. The main current work in the Forest Ecology and Soil Science Section concerns comparative studies on ecological aspects of growing domestic and exotic tree species, with particular attention to the poor diluvial soils of northwestern Germany. In the Forestry, Silviculture and Forest Protection Section, research is under way on the technique and prospects of afforestation of wasteland, the application of laws of growth to the diagnosis and forecast of increment, seed physiology and the root system of forest trees. For practical purposes, tree diseases and the biology of forest pests, particularly in exotic tree species grown in northwest Germany are being observed. The Forest Engineering and Utilization Section, still in the process of being built up, has started research on the improvement of extraction and transport. The Forest Genetics and Forest Plant Breeding Section with its 20 hectare Tannenhoft arboretum has been very intensively developed since 1948. Furthermore, it is to be expanded into a very much bigger institute, because in this field Germany has to make up for much lost time. An inventory of parent stock and grafted plantations is being established. Progress has been made with hybridization of *Larix*, *Pinus* and *Picea*, and the breeding of *Populus* and *Betula*. The Institute of Applied Mycology and Wood Protection in Hann.-Münden is a federal agency conducting official tests on forest protection measures

under the auspices of the Federal Biological Institute of Agriculture and Forest Economy at Brunswick. Of its work a recent investigation on the cause of the misnamed "beech dieback" is particularly worth noting.

The Forest Experiment Stations

German Länder without forestry schools have forest experiment stations responsible directly and solely to the forest administration. They continue the work of decades in existing experimental plots, and tackle current problems of urgent interest to the forest administration of the particular Land. Certain priority has recently been given to the evaluation of old experiments and the starting of new ones on fertilizer application, techniques, costs and the consequences of new growth care.

This group of research establishments comprises:

The Hessian Forestry Experiment Station at Giessen, Brandplatz;
the Wuerttemberg Forestry Experiment Station at Stuttgart and Tübingen;
the North Rhine-Westphalia Forestry Research Institute with the Institute of Silviculture at Bonn and the Institute of Growth Research at Lintorf near Düsseldorf.

The last of these has begun operations that go beyond the present scope of work of the forest research stations, as outlined above. The work being done there includes the measurement of respiration and transpiration of the most important European and North American trees to be introduced in the near future, in order to determine the intensity and economy of their metabolism, their reaction to the lack of light, drought, waterlogging, soil acidification and lack of certain nutrients. In addition, research is being conducted on heat generation of various trees.

Private Research Stations

There are at present only two non-governmental institutes, in the Federal Republic.

The Institute of Logging at Reinbek near Hamburg, formerly at Eberswalde, which this year celebrates its 25th anniversary, has greatly influenced work methods in logging industries and the training of forest workers. Priority is given to the study of the effect of various conditions of work on the physical well-being of the workers.

The Scientific Institute of the German Poplar Association at Brühl near Cologne is working out te basis for as broad an expansion as possible of poplar cultivation outside the forest proper, particularly in commercial plantations. The study of these problems is of particular interest to the German pulp and paper industry which is suffering from a shortage of raw material.

To sum up, the University Institute and the Länder Experiment Station are working mainly on regional forestry problems of their respective Länder, and particularly on site appraisal, silviculture and forest management, while the Federal and non-governmental institutes handle supra-regional matters. However, this division of labor is not clear-cut or absolute, for all research, workers are allowed, after having fulfilled their assigned duties, the time and the n pursue research work of their own choosing manner the most important problems are being i tigated by various institutes and often by diffe methods. This undoubtedly shows the possible ad age of spreading German forestry research ove large number of relatively independent institutes. notable disadvantage of such an arrangement however, that as a result of splitting up the generally limited research funds, certain unavoidably expensive research work can only be inadequately dealt with, if indeed at all. Research institutes doing this type of work will therefore have to be provided with funds for the specific purpose. Thus, for example, the following activities might be promoted: the development of rational statistical methods for assessing stock, growing increment and forest output; the working out of practical, effective methods for improving degraded stands (farm-forests) and for the afforestation of wastelands; work on genetics and breeding of forest plants.

The results of the research of German institutes are published in several professional journals. The teaching staff of the Freiburg and (Hann.-Münden) have collaborated for 123 years in the publication of the "Allgemeine Forst- und Jadzeitung"; "Forstwissenschaftliche Centralblatt" (Central Forest Science Journal), has been for the past 71 years, the organ of the Munich Institutes. Both publications carry original articles on problems and results of research in various German forest areas. The "*Forstarchiv*" prints, in addition to short articles covering the latest scientific and technical achievements, a very careful and comprehensive abstracts section; the "*Zeitschrift für Welforstwirtschaft*" is the organ of the Federal Forestry Institute at Reinbek. It prints original papers, particularly those dealing with the world-wide interdependence of forestry and wood-using industries. The very exhaustive abstracts section is also world-wide in scope. A new paper, "*Zeitschrift für Forstgenetik und Forstpflanzenzüchtung*", edited by the Forest Genetic Section of the Federal Forestry Institute is in its first year.

To the above list should be added the following publications, which do not appear regularly but only when valuable original contributions are to be published: "*Schriftenreihe der forstlichen Fakultät der Universität Göttingen*"; "*Mitteilungen aus der Staatsforstverwaltung Bayerns*"; "*Schriftenreihe der badischen forstlichen Versuchsanstalt*"; "*Mitteilungen und Merkblätter der Bundesanstalt für Forst- und Holzwirtschaft*" including the supplement "*Bibliographie des ausländischen forst- und holzwirtschaftlichen Schrifttums*". Finally, we should mention the "*Allgemeine Forstzeitschrift*" and "*Forst und Holz*", which endeavor to inform the broad group of forestry workers, including those in the middle and lower grades, of advances in the field of forest economy.

Seven years after the end of World War II, there are again 40 institutes of varying sizes doing fruitful forest research work. As yet, not all the ravages of the war have been made good and several institutes are not working to capacity through lack of adequate equipment and working capital. The reorganization of German forest research, however, has probably now in fact been completed.

Forest Products Research

A Central National Institute of Wood Research, replacing the Prussian Wood Research Institute set up in 1934, was established before World War II at Eberwalde. On the collapse and partition of Germany, it ceased to exist, and the revival of timber research in West Germany has been slow and difficult; but important results have been obtained and this paper is an attempt to survey some of these achievements.

Biological wood research

Munich

H. von Pechmann is in charge of the Institute of Wood Science and Forest Utilization at Munich. He recently issued a short bulletin on the "Basic problems of growing commercially valuable timber", a subject which is the prime concern of biological wood research. Besides correct seed selection, care of the stand is a decisive factor. From investigations of stem growth in pine, it would appear that timely thinning of young stands is essential to produce the best quality logs and prevent decreasing width of annual rings. If crown development is hindered, permanent loss in increment results. This applies equally to larch. Broader annual rings characterize the better quality and tougher woods of ash, oak, and elm and inadequate crown development detracts from wood quality. Quick grown broadringed wood is desirable in beech, and only ash veneer wood should be fine-ringed. Von Pechmann's studies have been carried out in collaboration with the Institute of Silviculture; the effect of natural phenomena and weather, hail storms for example, on increment and the quality of wood are also being investigated.

Von Pechmann, together with O. Schaile, has further improved the impact bending method for testing the natural durability of woods and evaluating the consequences of fungus infestation and the effectiveness of wood preservatives. In this process, wood specimens measuring 8.5 × 8.5 × 120 mm are enclosed in a Kolle container with pure cultures of wood-destructive fungi; the test takes from 10 to 60 days. It was found that within a few weeks, dry rot almost entirely destroyed the strength of the wood. A loss of weight of only 5 percent corresponded to a 60 percent loss in impact and fracture resistance. Chemical analyses showed that alkali solubility was the best measure of the reduction of chain molecular structure. Further and more extensive series of experiments and additional field work are planned. Von Pechmann has also carried out impact and stress tests, as well as additional microscopic and chemical investigations on infected and non-infected sections of individual wood specimens, with a view to determining more accurately the effect of "red stripiness" on the properties of spruce and fir.

Work at Hann-Münden

A particularly interesting piece of work has been done by Mayer-Wegelin at the Hann-Münden Institute of Forest Utilization. Great variations in thickness and hardness inside the annual ring seriously affect wood quality, but it has not been easy to assess these features by testing methods hitherto used. There is, however, an easily-made instrument, the "Härtetaster", with which variations in the quality of the wood along the radius of the stem can be determined by the depth to which a thin needle penetrates at a number of adjacent points. The boundaries between spring and autumn wood, that can otherwise scarcely be determined, are clearly distinguishable. Mayer-Wegelin has also worked on the special properties of poplars, the problem of removing bark from beech, and the effect of hardening on the properties of beech.

R. Schober, at the Institute of Forest Management and Production, Hann.-Münden, has published a basic treatise on the formation of the annual ring structure, and has also written on the effect of drought on wood formation. His institute has also been working for some time on the preparation of grading rules for timber used for pitprops and for European larch.

Closely associated with wood research are technological investigations into the best designs for wood-cutting tools. In this connection, G. Reissinger and H. Gläser (Research Station for Lumbering and Logging Machinery, Hann.-Münden) have done research on the most suitable shapes of axes, bringing out the effect of wood moisture content, angle of strike, cross-section and annual ring growth in the test material, and the best chip thickness.

At the Institute of Forest Botany at Munich, B. Huber and his students have made some remarkable contributions to biological wood research. They have further developed a system of annual ring chronology, based on the supposition that the width of the annual ring can in all probability serve as a direct measure of rainfall during the growing period. This is of value not only in meteorology for ascertaining climatic changes in the past, but also to forest history. Mention may also be made of work on the physiology of bark peeling in spruce and oak, on the structure of pine wood, on domestic sources of tannin supply, and the pathology of *Armillaria mellea*.

Interest in Poplars and Willows

Poplars, on which much interest is focussed in German forestry, has been dealt with in two publications, "Pappeljahrbuch 1947" (Poplar Yearbook) and "Pappelbuch" published by H. Hesmer. In these publications, well-known experts have dealt with the biological properties, culture, and utilization of poplars. The mechanical and chemical properties of poplar wood and their improvement are also discussed, as well as the economic significance of poplar growing and its relation to agriculture.

Special attention has been devoted by the Institute of Logging at Reinbek to the willow as another quick-growing, soft, deciduous species. This Institute is working on the rationalization of logging operations, studying the utilization of previously disregarded material useful in agriculture, for instance as supports in market gardens. Since knowledge of true solid content is essential for accurate time-studies, volume determinations on a number of commodities (logs, poles, pulpwood, and pitprops) have been made.

Wood preservation

Wood preservation has always been regarded as essential to the economic use of commercial timbers, and has been increasingly studied in Germany since 1945. The Berlin-Dahlem Materials Testing Laboratory has produced no less than 46 publications on wood preservation since 1946. The Wood Preservation Section now has seven laboratories, three fully automatic air-conditioned rooms, some experimental cells, and roughly 2,000 m^2 of land for field experiments.

Some of the many research problems dealt with by the research staff are the testing of woods for resistance to white ants; the reaction of woods to salt impregnation; the effect of coal-tar oil preparations on insects and fungi; the ecology of the beetle *Hylotrupes bajulus;* new tests and experiments with wood preservatives.

H. Seekamp has been working on the prevention and combatting of fire. A particularly important piece of research has been carried out on iron corrosion caused by wood preservatives, and a considerably simplified form of the vat-dipping process for the preservation of woods has also been tested.

W. Bavendamm, at the Federal Institute of Forest and Wood Economy in Reinbek, has conducted systematic investigations on the effect of the chemicals used in wood preservatives on fungi, and his conclusions are that the hitherto customary practice of evaluating wood preservatives only on the basis of the degree of penetration achieved is unsatisfactory, since there is no uniformity in results. This explains discrepancies between experimental results and practical experience. The test should rather be the concentration of the "preservative liquid" on penetration. Many other activities connected with testing the natural durability of woods, termite-resistance, deep impregnation, and the collating of all relevant literature are carried on at Reinbek. W. Sandermann and his colleagues in the Wood Chemistry Section have also concerned themselves with the chemistry of wood preservation. Wood preservation has in the past tended to be a subject for the pathologist and entomologist, and from this point of view, research had probably been carried as far as it could go. There is no doubt that many problems can still be clarified with the help of the chemist and his more perfected techniques. A first report by W. Sandermann, E. Schärfe and O. Froede relates to the depth of impregnation of corrosive sublimate in ordinary and improved cyanization. By means of a new colorimetric mercury determination, it has been possible to show that the true depth of impregnation of spruce by the sublimate is some 15 mm. more than that shown by darkening with ammonium sulphide. With a mixture of 66 percent sublimate and 6.6 percent salt, impregnation by the vat-dipping process can be increased 4 to 5 times. When steamed to 100° and 120° C., a spruce log 12 cm. thick is almost completely impregnated.

W. Liese, at the Institute of Applied Mycology and Wood Protection at Hann.-Münden, which is under the direction of H. Zycha, has carried out investigations on impregnation with oily wood preservatives. He found that the poor absorption capacity of spruce is due to an irreversible closing of the tracheids. In air-dried wood the closing of the tracheids is arrested or relaxed by various treatments. In wood, preliminary alcohol or acetone applications keep the tracheids open, and the timber can be fully impregnated with oil.

An important piece of research by H. Zycha concerns "red heart" in beech. The theory has been evolved that impregnation of the tracheal cavities with oxygen is sufficient to cause tylosis. Investigation of water distribution in standing beech stems shows that red heart always penetrates to the point where the water content reaches some 60 percent, in relation to dry wood. All the capillaries remain free of water while the conducting cells still retain their turgor. Since culture experiments show that red heart only occasionally contains fungal hypae, its formation cannot be a reaction to fungus irritation but must be physiological. "Frostheart" or dieback due to frost is a particularly severe form of red heart, caused by excessive air penetration of the trunk. Hardening in beech wood is a matter of localized change from sapwood to hardwood. Preventive treatment promises results only if the air and water conditions are taken into account. Zycha has also established a procedure for testing recently developed chemical preservatives against blue stain, which according to recent results, gives quick and reliable figures.

Some other activities connected with wood preservation which may be mentioned are research by K. Gösswald, Institute of Applied Zoology, University of Würzburg, on the protection of standing timber against insects; by W. Zwölfer, Institute of Applied Zoology, University of Munich, on the control of bark beetle pests of oak; H. Stolley, Institute of Wood Research, Brunswick-Querum, on the protection of synthetic wood products, particularly chipboards, against wood-destroying fungi and termites; H. Schmidt, Reinbek, on the protection of industrial timbers against termites, *Teredinidae,* and noxious beetles.

Wood chemistry

Wood chemistry research extends far beyond the province of forest and timber economy and cannot be dealt with at length in this paper. It should be remembered, however, that without knowledge of wood constituents, their formation and association in the cell-wall, it is impossible to assess many physical and mechanical wood problems. For example, the chemical structure of wood and of cellulose explains swelling and shrinkage, elasticity, and other physical properties. The correction of collapse, which is of major interest to the mechanical wood industry, is a chemical problem; and the majority of wood discolorations can be explained mainly on chemical grounds.

Much important work has been done in West Germany in these and similar fields. There is, first of all, the work of H. Staudinger, who celebrated his 70th birthday in March 1951. Staudinger is the founder of macro-molecular chemistry and the creator of the empirical viscosity equation which has made it possible to determine the average chain length of substances like cellulose and their associated carbohydrates. He has also investigated and demonstrated the connection between physical properties and degree of polymerization of celluloses, and found that the

cellulose filamentary molecules can undergo a series of stages of crystallization. His work since 1945 and that of his school would alone fill a separate article.

K. Freudenberg and his school, at the Chemical Institute of the University of Heidelberg, have been doing basic research on lignin, the second most important constiuent of wood. Publications have recently been issued on the bio-chemical synthesis of lignin-like substances, on spruce lignin and its synthetic production, on soluble lignin from spruce and beech, and on infra-red spectra of lignin and lignin-soluble substances. It has been possible to separate out lignin from wood in an apparently unchanged state, so that it can now be compared with synthetic lignin. It has also recently been possible to synthesize sinapin alcohol, the basic element in hardwood lignin.

Much significant work has been done since 1945 by G. Jayme and his colleagues at the Institute of Cellulose Chemistry, Darmstad Technical University. Jayme and M. Harders-Steinhäuser have been studying a new method for microscopic detection of proto-lignin in plant cell-walls, and its application in beech. The problems of the chemical definition and utilization of quick growing poplar wood have also been studied. One investigation dealt with the influence of variety and site on the chemical composition and suitability of poplar woods for cellulose manufacture; other studies dealt with the determination of cellulose content and other chemical research on poplar woods.

At the Institute of Papermaking, W. Brecht has been exploring the multiple problems of papermaking technology, ranging from chemical and stuctural comparison of cellulose through bleaching to infra-red drying. Mention may also be made of W. Klauditz's work on the chemical composition of beech and poplar wood and many similar subjects.

Finally, recognition must be accorded to the wood chemistry work carried out in the sections concerned at Reinbek. R.O.H. Runkel has devoted attention to the dissolving of wood with sodium chloride, the utilization of eucalyptus wood for cellulose production, and, above all, to wood molding by the application of heat. Besides his work on wood preservation, W. Sandermann has been working on the chemical utilization of tree stumps, the transformation of lignin and wood with anhydrids of dicarboxylic acid, and the effect of chemical factors on the strength of cement-bound fiberboards.

Mechanical wood technology

In view of the present need for rapid application of the findings of research in mechanical wood technology, attention has been focussed on the following points: wood seasoning with its basic physical laws; the elasticity and strength of wood and wood-derived materials; improving the economic status of wood, that is to say, creating new and valuable wood products; glued woods; wood processing; and the economical use of wood in construction. F. Kollmann and R. Keylwerth, at Reinbek, have published a bulletin "Beiträge zur Kraft-und Wärmewirtschaft in der Holzindustrie" (The use of power and heat in the timber industry), which is the first of a series entitled "Holzfragen der Gegenwart" (Present-day timber problems). The second volume in this series comprises several reports by Kollmann on the wood economy, research and timber industry of Sweden where he worked for some years on many problems. Continuing the work he started in 1932, Kollmann has devoted further attention to the properties, testing and grading of fiberboards and chipboards.

After several years' work, the first volume of the completely revised and greatly expanded second edition of the book "Technologie des Holzes und der Holzwerkstoffe" (Technology of timbers and wood materials) was brougth out in 1951. The periodical "Holz als Roh- und Werkstoff" (Wood as raw and industrial material) began to be re-issued in 1951.

R. Keylwerth has dealt with the mechanics of wood shrinkage, the simultaneous drying and impregnation of wood with hot oils, the relation between cleavage, shear resistance and lateral strength of woods, stress distribution in the traction joints with varying profiles or sections, the anisotropic elasticity of wood, and veneer drying. Courses at Reinbek devoted to special problems of wood technology have been greatly appreciated by the timber industry and trade, and have made it possible to demonstrate the equipment of the Institute to a wide public.

The wood physics and technology section has, in addition to strength-testing apparatus, an experimental drier with an infra-red chamber, high-frequency generator and the necessary optical and physical instruments.

The Institute of Technical Wood Research at the Stuttgart (under O. Graf and his deputy K. Egner) is mainly concerned with testing and research in organic or related building materials. In addition to determining the mechanical properties of woods, and of building and industrial materials containing wood, investigations are carried out on glueing, wood seasoning and heat drying; the behavior of wood-bonding materials, and of building and construction parts; injuries of all sorts to wood, and the behavior of wood in the event of fire. Vapor condensation in building materials and building parts is being studied, and research is also being carried out on the thermal properties of wooden floors as compared with other types of flooring.

Testing timbers and materials

The Stuttgart Institute has at its disposal wood-processing machinery, a great variety of apparatus for testing static and dynamic stresses, a high-frequency plant, two wood-drying kilns, three air-conditioning plants, one tropical chamber, refrigerators, and a great variety of measuring instruments. The Berlin-Dahelm Materials Testing Laboratory is studying tensile strength problems of construction of timbers. A. Troche, professor of building techniques and timber construction at the Hannover Technical College, has been carrying out research on frame building designs.

In the Organic Materials Section of the North Rhine-Westphalia National Materials Testing Laboratory, the whole range of fuel and accessory materials and of solid building and industrial materials, is being worked on. A chemical laboratory analyses glues, paints and impregnating substances; there is

also a fully equipped technical laboratory where wood and wood materials are tested, including a resistance-testing machine for loads of from 6 kg. to 100 tons. Another laboratory has been fitted out for research on wood preservatives, where research being carried out included protection of poplar timbers, the interaction of glues and wood preservatives, and of wood preservatives and paints. W. Küch, the director of the section, is studying the durability of artificial rosin glues and has reported on his wartime experiments on producing improved wood by compression.

Research is also being undertaken on wood materials at the Wood Technological Laboratory, under A. Dosoudil, of the Bavarian Forest Research Institute. Material has been published on the durability of compressed woods and other subjects. Attention is drawn also to the work of H. Winter at the Machine-making and Light Construction Work Institute of the Hannover Technical College. Based on his wartime work on the principles of wooden airplane construction, he has compiled a useful book on construction with wood, with an abundance of figures, [illegible] diagrams. This Institute is also busy with the te[illegible] and utilization of semi-finished products and non-metallic materials used in machinemakin[illegible] H. Fahlbusch has produced a thesis on the bearin[illegible] strength of bolts in wood under static loads.

This paper cannot be concluded without som[illegible] reference to research work and publications relating to wood processing. In the Machine Tools Department at Hannover Technical College, work has been done under the guidance of O. Kienzle on wood screws, and the processes leading to chipping in milling machines. G. Pahlitzsch, head of the Department and Research Section on Machine Tools and Factory Management of the Brunswick Technical College, has issued a series of publications describing the latest position in wood-processing machine construction. Finally, mention must be made of the Experiment and Advisory Institute of Chemico-technical Wood Utilization at Hohenpeissenberg, the head of which, J. Rautnig, is an authority in this field.

Forestry Trends in Spain

This account is based on a report submitted to FAO by the General Directorate of Forests, Hunting and Fishing, Ministry of Agriculture, Madrid.

Spain may be broadly divided into two contrasted climatic zones, separated by an intermediate zone where the climate is influenced by the other two zones and by local conditions of altitude, soil and topography. There is thus a typical Mediterranean Spain, essentially dry, and a purely Atlantic Spain, humid and with characteristics similar to those of the higher latitude or wet-climate forests. The Provinces of Murcia and Almeria on the one hand, and of Pontevedra, Asturias or Santander on the other, typify the extremes; between them lies the extensive intermediate zone covering the two Castillas, Extremadura, and other provinces, with far less extremes of rainfall.

In keeping with these very broad climatic divisions, there are at least three fundamentally different types of vegetation, which call for corresponding variations in silvicultural treatment and forestry practices. The distinct regional economic and social conditions have in fact given rise to different systems of forest ownership. The national forest policy of Spain has to be sufficiently flexible to adapt it to the varying resources and conditions to which it has to be applied.

General Policy

Spain is deficient in all types of timber, although there is a surplus of other products such as resin, cork and esparto, which can feed the export market.

The country's present annual production of industrial wood is roughly estimated at some 2.8 million m³, and requirements are calculated to be:

	Million m³
Construction timber	1.30
Pitprops	1.00
Transport	0.35
Paper	0.50
Poles	0.40
Packaging	0.60
Miscellaneous uses	0.15
Total	4.30

The general forest policy is naturally influenced by that consideration of the large deficit and the aim is to level out the unfavorable balance by afforestation of unused land and by increasing the yield from areas already under forest. It is not imagined, however, that full self-sufficiency in timber is possible, for there are species that cannot be acclimatized to Spanish conditions and some types of timber that will always need to be imported.

The keynote of forest policy is perhaps reforestation, the problems of which vary according to the geographic region. In the north and northeast, and in the Atlantic strip adjoining the southern frontier of Portugal, conditions admit of reforestation with quick growing species. The possibility of quick and handsome returns has lead to profitable collaboration between private owners and the Government.

The position is quite different in the dry region of the Mediterranean coast and in the central zones of the Peninsula, where it is difficult to acclimatize species other than the traditional pines and oaks, whose slow growth precludes early financial returns. Here, therefore, landowners prefer to graze livestock rather than grow trees, with consequent serious impoverishment of soils and hastening of torrent development. The State, nevertheless, endeavors to overcome the landowners' reluctance to undertaking reforestation by offering special inducements.

Higher yields from existing forests imply an increasing need for bringing all areas under systematic management plans. Many Spanish forests are already subjected to long-term plans, but the remainder are still worked on short-term plans, prepared by experts of the Administration. There has recently been a trend to change over from provisional schemes to proper working plans aimed at the conservation and constant improvement of the forests.

State interest does not end with reforestation and improved yields. The Administration is actively promoting the study and solution of many other problems, such as the control of torrents and "ramblas" (a particular type of torrent found in the eastern parts of the country), avalanche control, the fixation of unstable soils, the achievement of a balance between grazing and forestry, the protection of catchment areas, the construction and improvement of forest tracks, pest control, fire prevention and fire-fighting, the training of professional staffs, research, and improved utilization of forest products.

Administration

Of the 25 million ha. which are in fact classed as forest land in Spain (this includes land actually under forest and bare land), considerably less than half a million ha. belong to the State. According to the latest statistics, ownership of forest lands is distributed as follows:

	Ha.
Public utility forests	
State forests	453,827
Forests owned by communities and public institutions . . .	5,834,194
Total . . .	6,288,021
Private forest lands	
Communal forest land	1,504,566
Privately-owned land	16,810,169
Total . . .	18,314,735

The Spanish Forest Administration is associated basically with the Ministry of Agriculture through the Directorate General of Forests, Hunting and Fishing, and has the following special branches and services: lands; staff; reforestation; economics and statistics; utilization; and management.

The Directorate also controls the fifty District Forest Offices which are in charge of all forestry matters in the respective Provinces. Directly associated with the Directorate are the Institute of Forest Research and Experimentation, (*Instituto Forestal de Investigaciones y Experiencias*), the highest institution devoted to special research work, and the School of Forest Engineers, where the technicians needed by the State for its various programs are trained. This school, like all educational institutions in Spain, is also the concern of the Ministry of Education.

Also responsible to the General-Directorate of Forests are the so-called Forest-Waterways Divisions, which have the special task of protecting catchment areas, an undertaking closely related to other economic activities such as hydro-electric development, irrigation, and soil conservation.

A parallel body to the General-Directorate of Forests, with the Minister of Agriculture as its Chairman, is the Directorate of the State Forest Domain (*Dirección del Patrimonio Forestal del Estado*) which, in view of the limited extent of forest property directly owned by the State, is mainly concerned with reforestation on denuded public lands, and with fostering co-operative arrangements with private owners under the special State Forest Domain Law (*Ley del Patrimonio Forestal del Estado*). State collaboration in private reforestation is either on a fully co-operative basis or by providing cash subsidies, technical advisory services, seedlings from State nurseries or simply seed.

Over and above all these bodies is the Supreme Forest Council (*Consejo Superior de Montes*), a consultative and advisory body to which forest policy matters of major importance are referred.

The General-Directorate of Forests receives its funds out of the national budget but also uses 10 percent of profits derived from the annual sales of produce from public utility forests belonging to municipalities. Amounts realized in this way are re-invested in the forests in the most suitable form. The State Forest Domain is financed, for the most part, from a large State subsidy and from the income derived from its own capital resources, although this is not very substantial.

Some Activities of the Administration

Conservation of forest land is governed by legislation which prohibits any cultivation, irrespective of ownership, which is not approved by the Ministry of Agriculture. Apart from other measures that contribute to land conservation, there are avalanche control works in the Pyrenees and torrent control works in the slopes of the Sierra Nevada. Extensive control of "ramblas" has been undertaken with excellent results. Control works also exist in the upper waters of many Spanish rivers where marked torrent conditions prevail, and work carried out in the neighborhood of Malaga, for instance, has relieved the town of periodic threats of serious floods. The *Seccion de Hidraulica Torrencial* in the Institute of Forest Research is responsible for perfecting techniques and methods; it has an experiment station at Lanjaron in the Sierra Nevada.

In the few locations where unstable dunes occur in the Peninsula (in the southwest end of the Gulf of Rosas) fixation has been successfully carried out and afforestation undertaken with excellent results.

As regards forest protection, the District Forest Offices are responsible for pest and disease control, and they have adequate qualified personnel for such work. The Institute of Forest Research collaborates

closely. The Administration has for some time been preparing a Bill covering fire control for the whole country, based on a Law for Forest Preservation already in force in the Basque provinces. The Bill has been the subject of close study and may be expected shortly to become law.

Fellings in all forests are strictly controlled, with a view to ensuring subsequent regeneration. The Administration also recommends silvicultural measures for improving the natural condition of stands and the quality of the products.

Forest Products Industries

All matters connected with the timber industry are under the control of the Timber Department which is responsible to the Ministries of Agriculture and Industry. It deals with price policies, conduct of industries, licensing, transport, distribution and foreign trade. Increased attention is being paid to the utilization of logging and sawmill waste, and there some fireboard manufacturers are now using such raw materials.

Besides the sawmilling industry, there is a flourishing plywood industry, mainly in Valencia and Bilbao. There are wood distillation plants in the north, and the largest cellulose mill is situated in the Province of Santander, in the heart of an area extensively reforested in recent years. The paper industry operates at Guipuzcoa and Vizcaya, and is gradually being developed in other parts of the country.

However, some of the so-called minor forest products of Spain are of such economic value that they should be developed not as secondary but as principal commodities. For instance, there are some 18 million pin being tapped for resin, with an annual yield of som 45 million kg. This resin gives 20 percent turpentin and 70 percent colophony, with some valuable distillation residues. The importance of this industry is reflected in the remarkable increase in the number of factories processing derived products. A central agency *Commercial de Resinas* controls sales on the home and foreign markets.

The cork oak, found mainly in Andalusia and Extremadura although there are large stands also in Catalonia and other provinces, is the basis of an industry of particular importance for Spain's trade balance.

Esparto grass, with an average annual crop of 1,300,000 metric quintals, plays a big part in the economy of the southeastern part of the country. It is used in the oil industry and for rope-making, packing, paper-making and so forth.

Conclusion

Erosion and soil protection, reforestation, timber markets and wood-using industries, raise different problems region by region. The course of history, bringing changes in environment, the destruction of resources, and varying land tenure structures and land settlement arrangements, has profoundly affected the face of the Spanish country-side. Government laws and plans must, therefore, be broadly conceived in order to fit a variety of circumstances, and this is the purport of today's national forest policy in Spain.

Forestry Mission in Mexico

One of the largest FAO forestry missions is operating in *Mexico*, with D. T. Griffiths (U. K.) as Chief of Mission. The general object of the Mission is the economic development of forests and forest products. Particular emphasis is laid on conservation, for it is appreciated that true conservation is wise management, utilizing to the full a progressively increasing annual yield while protecting the capital. Full utilization and the elimination of waste is also a problem which causes the Mexican Government serious concern.

It will be appreciated that Technical Assistance officers do not work in water-tight compartments, but that most problems involve close co-operation between several specialists. All are also concerned with research and with a final recommendation for a well organized Institute for research in forestry and forest products. All assignments have some bearing on policy, legislation and training.

It is early yet to assess progress as work was slow in getting started. Mexico is a large territory, 4 times as large as France, with a great variety in its topography, climate, soil and forest types, and the Mission has been handicapped by lack of basic information on local conditions. Progress to date can best be indicated by dealing with each specialist separately.

Silviculture — As a result of a number of tours over a period of 8 months the silviculturist has studied most of the problems implied in this assignment; namely, reforestation in temperate and tropical forests and silvicultural and management practices in both types of forests. In addition, on the instructions of the Government, he has examined special problems in the Necaxa drainage area which provides electric power, and in the region of Aguas Calientes in the dry zone where an irrigation system exists. In the Yucatan peninsula, which contains the greatest part of the precious tropical species (mahogany and cedar) in forests extending over some 5 million hectares, he has made a special study of the forest economy in general.

The results so far are difficult to assess but this expert has submitted general recommendations for long-term planning of reforestation, which are still under consideration. Certain specific recommendations are already being put into practice, especially as regards choice of species for each natural region and provision for a special study of eucalyptus, acacia, mahogany and cedar.

Perhaps the main and most satisfying result so far has been a very fruitful co-operation with local technicians and an agreed common approach and perhaps a common doctrine on general policy.

Entomology — The entomologist has prepared a program of studies to serve as a basis for the control of forest pests in Mexico. He carried out a preliminary study of the causes of mortality of *Cedrela odorata* in Yucatan in conjunction with the silviculturist and initiated a series of field experiments based on his tentative conclusion that the primary injury is due to sun-scald. During his visits to Yucatan, he also inspected milling and logging operations and made proposals for dealing with ambrosia and powder-post beetle infestations. His recommendations for dealing with the latter were adopted with the result that infested piles in the yards were cleaned up by running the lumber through the dry kilns, and a dipping vat will soon be in operation.

In conjunction with his Mexican collaborator he initiated a demonstration where several methods of bark beetle control could be demonstrated and evaluated; the results cannot be properly evaluated until late this year. The entomologist also made a study of a severe defoliation of ash trees in the National Park at Uruapan and submitted recommendations for control which are being adopted. He also assisted in setting up in the Department of Forest Protection a central collection and note file system similar to that used by the U. S. National Museum.

Inventories — The specialist inventories officer, working with a very forceful Mexican technician, helped to start a permanent office of forest inventories which has functioned for several months. The organization of teaching and the training of personnel is well under way and 8 trainees are at present receiving instruction in the preparation of base maps, mechanical triangulation, photographic interpretation, the use of transferring devices and height determination. The office and training have been organized in connection with a pilot project for a forest inventory of Mexico State under the direction of the expert's Mexican colleague. Progress of work on this inventory may be summarized as follows:

Area to be studied . . .	12,000 Km²
Base map prepared . .	9,000 Km²
Photographs integrated.	12,000 Km²
Photographs transferred	5,000 Km²
Preliminary maps finished	3,000 Km²

So far however insufficient ground work has been carried out. A preliminary project has also been presented for an inventory of the State of Durango. Both Mexico and Durango States are in the temperate zone and nothing has yet been done in the tropical forests where inventories are particularly important.

Study of the Pine Lumber Industry — While under the Direccion General Forestal, an expert spent six months in the pine areas of Chihuahua and Durango acquainting himself with the problems of the local industry. Plans were prepared to modernize sawmills and various suggestions were discussed with lumbermen to rationalize their exploitation and milling systems. The interim report contains short-term and long-term recommendations. This expert was then employed in assisting the Forest Products Investigations expert in the first phase of a pulp and paper study, and then worked on the study of railway sleeper production. There are however further problems to be studied in the pine lumber industry, collaborating with the pulp expert and with the silviculturist so that his proposals take full regard for conservation and proper silvicultural management.

This expert has also made proposals, acceptable to the Mexican authorities and now being examined by FAO, for the provision of certain demonstration machinery (including modern gangsaws and machines for sawing staves, etc., out of slabs) to convince lumbermen of the advantages of modernizing their machinery. In connection with his studies in Mexico, he will shortly make a study trip to the USA, accompanied probably by a Mexican technician under a traveling fellowship, to visit pine regions where conditions are similar to those in northern Mexico, with a view to evaluating modern developments.

Forest Products Investigations — For various reasons, little contact has been possible with industrialists, but the expert, whose contract has now

terminated, prepared a firm project for a research laboratory comprising the following sections: documentation, anatomy, physical and mechanical testing of wood. The Government has allotted 170,000 Pesos for the purchase of the necessary equipment which should arrive later in the year. Instructions on the laboratory methods to be used in the study of the anatomy and the physical properties of wood has also been prepared.

This expert also, in co-operation with the chief of the mission and the silviculturist, carried out a reconnaissance of the Michoacan paper pulp project. After completing this work with the Direccion General Forestal, the expert prepared for the Bank of Mexico a draft project for the creation of a cellulose research laboratory, which seems fully justified in view of the fact that Mexico imports at present some 120,000 tons of cellulose and paper products towards its consumption of about 300,000 tons. In connection with this work he toured in the Papaloapan basin and suggested a program of work suitable for the creation of bamboo plantations for the production of cellulose, and for the study of Mexican grasses similar to "La Canne de Provence" for the production of alpha cellulose. On his return to France on the conclusion of this mission he has been assigned [illegible] to study and provide a repo[illegible] Mexican Government on cellulose [illegible] search laboratories in that coun[illegible]

A pulp and paper specialist has n[illegible] been added to the Mission, to follow up the proposals of the Forest Products Investigations Expert outlined above. He will advise on the development of cellulose research; to examine all raw materials and existing projects, and to advise on a plan for future development of pulp and paper production. Another new member is a consultant on the general economy of the Desert and Semi-Desert Areas, which are of great importance to the country.

Torrent and Avalanche Control

The French Government was recently host to some 45 foresters attending a study tour on torrent and avalanche control. Recommended by FAO's European Commission on Forestry and Forest Products, this study tour across the Alps from Nice to Evian, 28 June to 8 July, was admirably organized by the French Forest Service. Representatives of the following countries attended: Austria, French Union, Germany, Italy, Iran, Spain, Switzerland, Turkey, United Kingdom (Cyprus), and Yugoslavia. Descriptive literature and maps showing the geology and vegetation of the regions to be covered by the tour, and also details of each of the projects to be visited, were distributed in advance. Many reports on particular topics of interest, presented by those taking part in the tour, were published and distributed.

The Director-General of Waters and Forests, France, in his speech of welcome to the delegates at Nice, gave a lucid account of the present forestry situation in these regions, emphasizing the close relationship of torrent control with soil conservation and land use generally, and with the whole manner of life in mountain districts. The French Government, he said, had been anxious to organize this study tour because France was the first country to try to solve problems of erosion attributable to torrents, and it had been French engineers and foresters who had laid the foundations for all present methods of control.

A full report on the study tour is being published separately but the following brief notes give an idea of the ground covered. In the southern Alps the members were able to study the problems of torrents which normally carry little water or are entirely dry, but which become exceedingly dangerous after local summer storms which sweep down into the valleys rocks and debris, large and small, which have accumulated in the upper reaches of the catchment areas. In Savoie and Haute Savoie, they saw torrents which carry a steady flow of water and which are constantly eroding their banks; when in spate, these torrents seriously endanger villages and croplands which lie along their courses, and roads and railway lines which cross them. In both these regions, it was also possible to study problems of protection against landslides and avalanches.

Two points in particular attracted the attention of members. One of the highlights of the tour was a visit to Serre-Poncon on the river Durance where the construction of a large dam is proposed to feed a hydro-electric plant and irrigate the lower valleys. The engineers in charge of this project explained the dangers that they foresaw if there should be any negligence in maintaining and extending the forested areas and control works which were the only means of holding in check the erosion caused by torrents emptying into the upper reaches of the Durance. The construction of this dam, they said, would completely change the aspect of the region, and present new problems in the control of torrents emptying into the river not only above but also below the dam. Study of these problems was still in an early stage, but clearly the construction of large dams of this nature brought new responsibilities to all those concerned with torrent control; this pointed evidently to the necessity of the closest co-operation between foresters and the dam engineers. In as much as the catchment area of a river forms a unit where the utilization of any one part affects the potential utilization of all the other parts, so too the river itself with its tributary system constitutes a unit which cannot be effectively developed unless every part is fully under control.

The second point to impress the members was the evident interest which the tour aroused in the districts through which they passed. Local spokesmen frequently made clear the importance that rural communities attached to torrent control. They were well aware of the role that forests played in the protection of soil and regulation of water flow, and therefore had an especial welcome for those who were responsible for protecting their forests, and for extending the forests as new erosion dangers emerged to threaten their possessions and their homes. Thus the members of the tour were made fully aware of the complex relationship between the particular problems which they were studying and the general background of living conditions in mountainous districts. As the Director of FAO's Forestry Division pointed out at the closing discussion session, torrent control is in itself a difficult operation, which, even at the price of large capital expenditure, is not always crowned with success. Success is certainly hazarded wherever excessive forest exploitation, over-grazing at the higher altitudes, or wrong agricultural practises are permitted on lands subject to erosion. The problem is fundamentally one of correct land use. On its solution depends the welfare and social development of the rural communities affected. They may decline and perhaps disappear; on the contrary, they can attain improved standards of living and well-being if their natural resources are cared for instead of being allowed to deteriorate.

For the present, the members of the study tour were confining their attention to what might be called the chronic diseases of the land and the possible remedies. Improvement of grasslands beyond the tree-line was not now their concern, but it was clear that, sooner or later, they must take into account all the complexities of land use in mountain areas. FAO's aim was that, in alpine regions, the interests of agriculture, forestry, hydro-electric engineering, and tourism, should all be harmonized.

Equipment News

Interest in the development of forest utilisation and woodworking industries is reflected in the continual demand for information on new equipment. FAO's Forestry Division collects such information and passes it, on request, to Member Governments. Some of the information collected is published here. FAO accepts no responsibility for the claims put forward by manufacturers.

FLASH-O-LENS. — A useful instrument for carrying out accurate inspections even under poor light conditions. Combines a magnifying glass with a powerful light built into the handle, thus clearly illuminating a magnified field of vision without throwing direct rays in the user's eyes. The lens system gives a clear flat field of vision, reducing distortion and aberration. Model illustrated, which is light and portable, magnifies 7 times. Other units can be supplied for 5, 20 and 40 times magnifications.

Abbeon Supply Co., 58-10, 41st Drive, Woodside, N. Y., U.S.A.

SCREW-MATE TWIST DRILL. — This new tool is called "Screw-Mate" because its profile matches the body shape of the corresponding-size wood screw. It is so designed that it will drill the tapered pilot hole, drill shank clearance, and countersink in a single operation. It is impossible to drill pilot holes too large or too small, and the shoulder on the tool stops the drill at the proper depth. "Screw-Mates" fit any drill gun, hand drill, or drill-press and are available in a wide variety of sizes to correspond with the screws used.

D. R. Carner Co. Inc., 106 Hospital Street, Providence, Rhode Island, U.S.A.

TANKER SUCTION BOOSTER EJECTORS. — These ejectors can be used to lift water 100 feet vertically or draw from reservoirs 200 to 300 feet away. The operating principle is that water is pumped through a built-in nozzle at high pressure into a diffuser chamber, where extra water is picked up or entrained by the high velocity stream. The ejector works most efficiently when it is submerged in the pick-up water. Under conditions of normal suction lift, water tanks can be refilled at twice the output of the pumper.

Weights of the ejectors of which seven sizes are shown, are from 1 1/4 to 14 lb. and there are no moving parts to wear out or get out of order.

U. S. Forest Service, Arcadia Equipment Center, Arcadia, Calif., U.S.A.

Gail & Scott Limited, 5 Drapers Gardens, London, E.C.2.

FORBES KWIK-CUT SAW. — A light, portable machine for pruning and cleaning, easy to handle and operate, especially over very rough ground where high pruning is required. It can easily be operated from an ordinary ladder; a few pulls with the starting cord will start the engine.

Specifications: The power unit is a single cylinder, petrol-oil mixture, two stroke engine of 1/3rd B.H.P., driving the saw through a telescopic driving shaft. The outer or supporting tube is also fully telescopic and swivelling, and can be locked in any desired position when the machine is in action. The saw gear-box is fitted to this supporting tube. The saw is 6 in. in diameter; it is fitted on the end of the driving shaft by an inner driving shaft, being located and held in place by a large machined head. At the other end it is secured by a self-locking nut. Saw weight, 20 lb.

G.E. Hook-on power factor meter. Type AK-3. — An instrument for measuring the power factor directly without cutting conductors or interrupting service. Measures both leading and lagging power factor on any balanced 3-phase current of 100 to 600 volts and 15 to 600 amperes. Enables checking of the need for corrective equipment so as to reduce power costs, and helps to determine where to locate corrective equipment so as to increase the efficiency of the distribution of power.

General Electric Co. Inc., Schenectady, N.Y., U.S.A.

P.T.I. Sharpening attachment. — The principle used here is new and patented. Blades are sharpened with a grinding wheel rotating in the same surface as the saw blade. Therefore, vibrations are eliminated and the grinding is done with a higher degree of precision. Less skill and time is required with this new sharpening method. The blade is sharpened by segments. Section by section is moved up and down past the periphery of the grinding wheel.

The foot of the attachment is screwed to a table beside the right-hand wheel of a bench grinder with center 5 in. above table. The foot has two slots which permit the movement of the attachment sideways so that the saw blade can move across and use the full width of the grinding wheel.

P.T.I. Inc., 401 Broadway, New York 13.

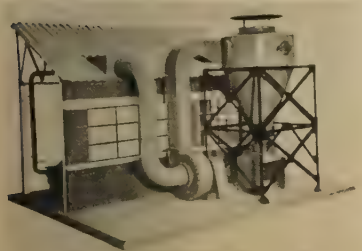
Rohr bummer wheels. — The Swiss Federal Institute for Forest Research has tested this equipment and found it to be very satisfactory and of durable construction. Compared to ground skidding of logs by cable, the traction power saved is in the order of 20 to 45 percent, according to the nature of the terrain. Damage to standing timber and tracks is also less and the time needed for man-handling of logs reduced. The wheels are most useful for heavy logs; to haul poles and branchwood the addition of a mobile bolster is recommended.

Specifications: Width of wheel track 88 cm.; total width 105 cm.; height of load 50 cm.; wheel diameter 47 cm.; total length 148 cm.; length of loading arm 132 cm.

Rosta-Produkte, Ernst Rohr, Staufen-Lenzburg, Switzerland.

Renault power-winch. Pan Model BT51. — This winch has been specially developed for skidding, clearing and grubbing. It has given good results on swampy and sandy ground and on slopes. Capacity 5,500 kg. with a cable 145 m. in length. The sprag-anchor is controlled from the driving-seat and does not impede the maneuverability of the tractor. By a cable guide the driver also controls the correct winding of the cable on the drum. If the effort needed is beyond the power of the winch, assistance can be given by hoist and snatch blocks. Accessory equipment is issued with the BT51 winch.

Regie Nationale des Usine Renault, Billancourt (Seine), France



Wood refuse and dust exhaust plant. — This machine incorporates a "Tornado" motor-driven fan and centrifugal settler, with duct connections to hoods serving a saw bench, spindle moulder, planing machine and "sweep-up". The settler is suitable for handling both seasoned and green timber and is an example of the range of standard sizes from 2 feet (0.6 m.) to 13 feet (4 m.) diameter. Depending on the nature of the refuse collected, the waste matter may be fed to boilers for steam raising purposes.

Keith Blackman Ltd., Mill Mead Road, Tottenham, London, N.17.

REMORQUE PORTE-TRACTEUR. Type RPT 8 tons. — The back-axle of this tractor-carrying trailer is removable by means of two elevating screws, permitting loading ramps to be fixed as shown in the photograph. Loading platform 3.9 m. × 2.4 m.; clearance 55 cm.; tires 270×20. Steering by front wheels. Hand and automatic brakes on rear axle. Deadweight 2,400 kg. Maximum speed 25 km. per hour.

Société R. Madurand & Cie, Chelles (S. & M.), France.

ALLMAN SPRAYER. — A machine specially designed and built for the United Kingdom Forestry Commission for spraying seedlings in nurseries with insecticides. It has a maximum operating pressure of 100 lb. p.s.i. and will apply liquid at both high and low volume. It is equipped with a speedometer to record up to 4 miles per hour, and is fitted with a drift sheet.

Allman Overseas Ltd., 7/8 Bury Court, St. Mary Axe, London, E.C.3.

HIAB TRUCK LOADER. — A crane that needs only about a foot's space on the frame between the body and the platform of the truck on which it is mounted, leaving the whole platform free for use. Symmetrically located in the center of the chassis, it can easily work on either side of the truck; a simple adjustment permits it to work also in front.

The lifting piston in the vertical main cylinder carries a telescopic boom, length adjustable from 3 ft. 3 in. to 11 ft. 6 in. Lifting capacity, depending on the length of the boom, varies from 1100 lb. to 2200 lb. The lateral movement of the boom is operated by hydraulic power swing pistons. Vertical and lateral operations are controlled to any speed and direction by means of a single lever on either side of the cab. No brakes, clutches or mechanical catches are used, all operations being fully hydraulic. By applying the block and tackle principle reversed on two groups of triple pulleys, the load rises and sinks seven times faster than the vertical piston; the crane has a working range from 12 feet below ground level up to 14 feet above, and a horizontal reach of 20 feet. The truck engine supplies power through a single-speed power take-off driving a hydraulic gear pump mounted in an oil tank, separate from the crane. Overloading is prevented by a by-pass valve in the hydraulic system.

Hydrauliska Industri Aktiebolaget, Hudiksvall, P. O. Box 117, Sweden.

R.J.H. RADIUS BANDFACER. — This machine is designed for form grinding and polishing small radius material; it uses a 36×4 in. band, with speed of 2,500 surface ft. per minute. Drive is taken from a 1 h.p., totally enclosed motor, which carries a 3 1/2 in. diameter driving pulley and is mounted on a pivoted platform to allow for belt tensioning. Idler bobbins from 3/4 to 1 3/4 in. diameter are provided for dealing with radii from 3/8 in. upwards, and are readily interchanged by removing the top cover of the steady housing only. Adjustable work table enables the full width of the band to be utilized, and has cut-outs of various sizes to suit the different diameters of bobbins. A flush mounted push-button starter is incorporated in the fabricated pedestal, which occupies a floor area of 24×16 in.

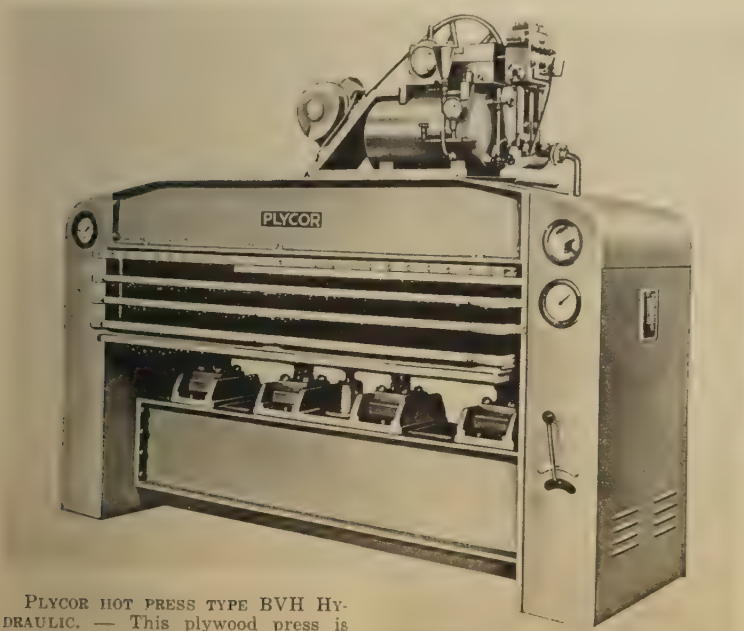
R.J.H. Tool & Equipment Co. Ltd., Heckmondwike, Yorkshire, England.

HAND AND POWER FEED PLANER (MOTOR DRIVEN) Type WR/T. — A machine for surfacing, thicknessing, bevelling, rebating, chamfering and moulding. It is entirely self-contained, having a standard motor housed within the machine frame. A short central belt drives from motor to both cutter head and feed; three rates of feed through constant mesh ball-bearing gearbox. Feeding system for thicknessing driven through enclosed chains and gears; thicknessing table adjustable vertically by handwheel. Surfacing tables carried on double wedge slides, enabling tables to be withdrawn for access to knives. Concentric lift pressure bars operate before and after cutter block, and are arranged to allow moulding to be carried out without their having to be withdrawn.

Specifications: Upper tables for hand planing 6 ft. long overall; cutterblock 4,000 r.p.m.; two cutters 1/8 in. thick × 1 1/2 in. wide and × 24 1/4 in. long; power feed rollers 3 1/2 in. diameter; rates of speed 26, 39 and 59 ft. per minute.

The patent fence can be moved to any position across the width of the table and will tilt up to 45°. The 6 b.h.p. motor is mounted on a swing plate inside the machine frame and is completely isolated from chippings. Space occupied - length 6 ft. 4 in. width 4 ft. 3 in.; net weight 3,472 lb.

Thomas Robinson & Son Ltd., Africa House, Kingsway, W.C.2. London.



PLYCOR HOT PRESS TYPE BVH HYDRAULIC. — This plywood press is specifically designed for the small and medium size firm and enables use to be made of all types of hot press adhesives. It is equipped with drilled steel steam platens, ensuring uniform plate temperature at all times; no pit is required; a maximum specific pressure of 100 lb./sq.in. is developed over the entire hot plate area. The machine operates on either high or low pressure steam. If steam is not available the unit can be equipped with a self-contained steam generator. Automatic electric pressure control.

The Type B.V.H. is at present available in one size only, 99 in. × 51 in. The frame is designed to accommodate five openings, but may be installed with anything up to that number; additional plates can be installed at any time.

Plycor Company, 365 W. Washington Blvd., Chicago, Illinois, U.S.A.

SPINDLE SANDER. — The principal characteristic of this machine is that it is equipped with a tilting spindle rather than a tilting table, so that the job on which the operator is working is always in a horizontal position. The spindle can be tilted from 0° to 45° by a worm and gear unit and can be locked in place at any desired position. It can be used with a wide range of abrasive sleeve adapters, from 1/4 in. diameter × 5 in. high to 4 in. diameter × 11 in. high. It is powered by 2 h.p., 220 or 440 Volts, 3 phase 60 cycle A.C., completely enclosed two speed motor. Speed is 2,000 or 4,000 r.p.m.

Kindt-Collins Company, 12651 Elmwood Avenue, Cleveland 11, Ohio, U.S.A.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for reference purposes. The Editor will be glad to receive direct from readers authenticated items of interest and of news value for this part of the review.*

General

CUBA

● The Youth Section of the Cuban Association for the United Nations is sponsoring the creation of "United Nations" Forests in Cuba. Much interest has been shown in this project in government circles and the first forest has been laid out at Cacahual, which is just outside Havana and is one of the most visited spots in Cuba, being the site of the tomb of General Antonio Maceo and his adjutant Panchito Goméz Toro. A special day known as "El Dia del Arbol" (17 April) was set aside when the first trees were planted and two children from urban and rural schools in each municipality throughout Cuba, as well as pupils from Universities, Teachers Training Colleges and other educational institutions in the Republic, came to Havana to join with school children from the capital in inaugurating the first forest.

CYPRUS

● With the opening last year of the new Forestry College at Prodhromos, Cyprus may claim to be the forestry center of the Middle East. The United Nations has sent some of its fellowship holders to study there; so have a number of neighboring governments.

The first course began on 1 October 1951 and among the students taking part were three from Jordan, four from Syria, two from Tripolitania and two from Iraq. It is hoped they will be joined eventually by trainees from Kenya, Uganda, Cyrenaica and the Lebanon. Fifteen of the 36 places the College offers are being reserved for students from overseas. Eighteen Cypriots are taking part in the first course, all of them members of the Cyprus Forest Service.

The full course lasts two years and is designed to prepare the student for the post of forester or forest ranger. The syllabus covers the basic sciences the forester needs to apply to his job, such as botany, geology, climatology and ecology; and specialized subjects such as silviculture, crop mensuration, protection, utilization, and surveying and engineering.

FRANCE

● An International Technical Tropical Timber Association, with headquarters at 16, rue de la Paix, Paris 8, has as its aims: (*a*) foster and maintain permanent contact between its members, (*b*) define, protect and co-ordinate their professional interests in all countries, (*c*) bring the recommendations and resolutions adopted by the Association to the notice of Governments and national or international organizations, and to uphold such recommendations and resolutions by all possible means, (*d*) study all problems, commercial, technical, fiscal, social, economic, etc., relating to production, transport, import, commerce, brokerage and processing, with a view to promoting the use of tropical timber, (*e*) assemble and communicate to the members of the Association all relevant information, (*f*) adopt all possible means of developing the production and use of tropical timber, and (*g*) to this end, to take an active part in publicity and in spreading knowledge with regard to tropical timbers.

The Association has set up study groups to examine the following subjects:

(1) Ways and means of (*a*) carrying out publicity to encourage the use of tropical timber, (*b*) collecting, as quickly as possible, documentation on the export and consumption possibilities of various species.

(2) Measures for the rapid standardization of statistics and despatch of information to importers and exporters.

(3) Questions of freight and Customs duties on an international scale.

(4) Specimen contracts. Codification of practices and methods of arbitration.

(5) The conditioning of tropical timbers.

MALAYA

● The Malayan Department of Forestry last year celebrated its 50th anniversary. In 1901, when the first Chief Forest Officer was appointed, there was no forest law, no constituted forest reserves, no research or silviculture, no sawmills, and a very small technical and subordinate staff. Today, each member state of the Federation of Malaya has adequate Forest Enactments, forest reserves cover 23 percent of the total area, there is an excellent Forest Research Institute and the only Timber Research Laboratory in the British non-self-governing territories.

The Malayan system of silviculture in tropical rain forest is based on a system of regeneration by improvement fellings, the most advanced of its kind, which is followed in many other parts of the Commonwealth. There are 228 sawmills with a capacity of over ½ million tons of sawn timber annually. All exploitation is on a strictly sustained yield basis. Income is around 5 ¾ million Straits dollars annually. There is a trained staff of 66 senior officers, a subordinate staff of 750, and 40 technical assistants. There is a Forest School with an annual intake of 50 students.

This progress is probably the most notable in any of the British colonies. It has been due to the quality and drive of the personnel of the Forest Service, and to the generous financial treatment accorded to the Forestry Department by the Government.

UNITED STATES OF AMERICA

● The 17th annual North American Wildlife Conference brought together about 1,000 conservationists, wildlife administrators, biologists and sportsmen, including representatives of Canada, Alaska and Mexico as well as of all the states of the U.S.A. Attention to integration of resource management was prominent in the proceedings, and the Conference adopted a national policy for natural resources covering management and restoration of all renewable resources, including soils, water, forests and wildlife. In addition, attention was given to practices and programs adversely affecting renewable resources conservation, notably the antiquated mining laws.

A large number of technical papers dealing with various aspects of fish and wildlife management reported the latest findings and practices developed by technical and management specialists.

Fundamental Science

NIGERIA

● The Nigerian Forest Department has set aside an 80-acre (32 ha.) plot to preserve in an untouched state a typical area of Nigerian forest. From evidence on the plot it seems that the area had been farmed about 150-200 years ago. The plot will now be opened only at fairly long intervals to accredited botanists for the purpose of studying ecological changes. Out of the total area of 80 acres, a detailed inventory has been carried out on 19.4 acres (8 ha.) which have been set up as a permanent sample plot. This carries 13.8 acres (5.6 ha.) of high forest, the remainder being broken forest,

tangles and gaps, windfall areas, etc. Topography, geology and soils have been investigated by means of sample pits. About 60 separate collections have been made, and the species identified and classified as emergents, upper story, lower story, herb layer, climbers and lianes, and epiphytes.

United States of America

● For over 40 years systematic studies have been made on the effects of livestock grazing on high mountain watersheds in the Intermountain National Forest Region in western U.S.A. Based on these studies, a handbook has been published by the U. S. Forest Service which enables a range manager to judge the conditions and trends of his lands.

"Condition" is the character of the vegetal cover and soil in relation to what it ought to be. "Trend" is change in condition, either toward improvement or deterioration. The diagnostic features by which both may be judged are called "indicators." The basis for judgement of condition is the normal, i.e. undisturbed condition, under which are found maximum soil stability and the most advanced successional stage of vegetation, with perennial rather than annual plants. Relict areas have to be hunted out to identify "normality" on the many complex range types, each of which is the result of distinctive combinations of factors — animals, plants, soil, climate and topography.

In 1948 a project was also undertaken by the U. S. Forest Service to develop a simplified method for measuring trend in range condition. The method now evolved entails three primary steps:

1. The permanent establishment of transects in clusters, to sample selected representative parts of the range and to be used for repeat observations in subsequent years. Careful selection of sampling area must be made to avoid spots too close to fences or water, or, unless the primary purpose is to determine climatic effects, too remote areas where grazing is light or absent. A ring $^3/_4$ inches (1.9 cm.) in diameter is used to determine the condition on spots 1 foot apart along each transect. The initial measurement of vegetation and soil conditions thus made can best be done early in the season when growth of vegetation makes species determination easiest.

2. Step 2 involves summary and analysis of the data for each cluster of transects. Vegetation is classified into desirable, largely perennial species of grasses; undesirable, largely herbs other than grass which occupy soils after elimination of perennials; and an intermediate group of species. Similarly, the percentage of bare soil is found by analysis of the small samples. Classification of condition and trend then depends on the proportions found to be made up of different groups of vegetation, different proportions of covered and bare soil surface, and the vigor of more important desirable species, all finally summarized into a rating of condition and probable trend.

3. The final step is to establish permanent points for photographs showing each transect in general and a particular small area of it in detail.

To apply the method, a prime requisite is that the worker should be able to identify range species, not an impossible expectation since, for any one range, the number is usually not great. Otherwise the method involves simply system, order and accuracy in recording primary observations.

As a test, the method has been applied successfully to sample range allotments after each allotment has been mapped into areas used and unused by stock, and further into primary areas furnishing most feed and secondary areas furnishing relatively small amounts of feed. These tests have also shown that administrative officers, given training in identification of plants and in the techniques of sampling, can apply the method effectively.

Silviculture

Chile

● An FAO technical assistance officer in Chile writes that the portion of the coastal *cordillera* lying between Rio Valdivia and Rio Bueno, a hilly tract rising to 3,300 feet (1,000 m.) above sea level, roughly 20 miles (32 km.) from north to south and the same from east to west, contains a number of large private forest properties and three blocks of fiscal land. The most valued species is alerce (*Fitzroya cupressoides*); exploitation of its timber has been going on for the past 35 years. Apart from this, there has been little development in the region which is almost uninhabited.

The growing stands are characterized by sudden changes in composition and quality; there are five main types of forest, of which two are predominantly *Fitzroya cupressoides* and three predominantly mixed, without *cupressoides* at all or with only isolated specimens. In the case of the *Fitzroya* types, which are of particular interest, the main associate species are three other conifers, *Pilgerodendron uviforum*, *Saxegothaca conspicua* and *Podocarpus nubigenus*, the first of which occurs particularly in localities where the growth conditions are wet and the height growth poor; the other two occur mainly in localities where *Fitzroya* is of better quality.

Stands of alerce of fair to good quality with trees up to 120 feet (37 m.) in height occur in sheltered situations at high elevations. On exposed slopes, flat ridges and plateaux at high elevations, trees are very stunted, sometimes only a few feet high. Alerce, however, [illegible] to be the one species able [illegible] stand the peculiar soil and cli[illegible] conditions found here, namely, sha[illegible] low poor soil derived from th[illegible] derlying mica schist and gneiss, o[illegible] dinarily saturated with moisture an[illegible] sometimes covered with a spongy layer of moss such as sphagum; strong westerly winds; and high rainfall. The mode of occurrence of the *Fitzroya* types, coupled with the great age of large trees, indicate that they are climax types for the locality.

Unfortunately, these climax types have been affected profoundly by fires and, in the case of the stands of better quality, by exploitation. There are few areas of alerce which have not been affected by forest fires. Particularly in the vicinity of former sawmills and on the high plateaux there are extensive burned forests, which must have been stocked with a dense growth of alerce at one time, judging from the great numbers of dead stems still standing. The damage caused by fire to these alerce forests is particularly calamitous since the trees killed were many centuries old, from the observations made in areas under current exploitation.

The past exploitation though done on a large scale, seems to have been concerned with the removal of only the largest and best trees. In this area there are many killed stems 6 to 9 feet (1.8 to 2.7 m.) in girth at breast height. Since both alerce and cipres (*Pilgerondendron*) timber is very durable, it is probable that much useful timber could be recovered from the killed but still standing trees. A sample of *Pilgerodendron uviforum* was cut from a pole which had been killed by fire 30 years ago and which had fallen subsequently to the ground. Apart from a shallow superficial layer of perished sapwood, the pole was perfectly sound.

The few remaining living alerce and cipres on the burned areas are of great importance as potential seed bearers, though fortunately on much of the burned area natural reproduction of these species is adequate, and in certain patches is superabundant, as many as ten plants to the square yard (12 to the sq. meter).

Apart from the forests at high elevations where growth is stunted, a feature of the forests of this region is an exuberant undergrowth of *Chusquea quila*, which makes progress through the forests difficult, especially in the absence of tracks made either by man or game. This undergrowth fortunately does not seem to impede the natural regeneration of shade tolerant species, notably *Saxegothaca conspicua*, *Podocarpus nubigenus*, *Drimys winteri* and *Laurelia serrata*.

Indonesia

● The teak forests of Indonesia are almost 100 percent pure, unlike those in Thailand, Burma and India. The popular belief is that teak was in-

troduced by the Hindus from India some ten centuries back and this accounts for the purity of the crop. It is also curious that, with the difference in the rainfall distribution i.e. from November to June in Indonesia as opposed to June to October in other teak producing countries, the flowering and fruiting seasons have adjusted themselves accordingly. Teak usually flowers from May to July in India whereas it starts flowering from December in Indonesia. Experiments with some Indian teak seeds show that the growth of wet zone seeds is very much superior to that of dry zone seeds; in other words so far as growth is concerned, the hereditary character is maintained even under exotic conditions. Another thing of special interest concerns *Dalbergia latifolia* (Rose wood) and a species of *Casuarina*. Both these species when interchanged between the north and south of the equator have lost their reproductive capacity. *Casuarina*, supposed to have been introduced from Thailand and now being extensively planted, does not produce any female flower in Indonesia. Similarly, *Dalbergia latifolia* brought from India does not produce any fruit under Indonesian conditions and plantations are established by root suckers from older trees.

As far as teak is concerned, the system of management is very intensive and the method of regeneration is clear felling followed by taungya. Unlike India and Burma, sowing of seeds is preferred to stump planting. *Leucaena glauca* is sown simultaneously to form an underwood mainly for soil protection and this incidentally meets fuel demand and gives an intermediate yield. The rotation is 80 years which is supposed to be a compromise between the financial rotation and rotation of maximum volume production. The present output from final felling is about 115 m^3 per hectare. Thinning is carried out at regular intervals and almost everything is saleable. The average increment is estimated to be 2.5 m^3 per hectare including small wood.

The protection forests covering the mountain tops and upper slopes contain species of not much economic importance. To meet the increasing demand, part of these forests are being converted into productive forests, and lower slopes are being clear-felled and planted with *Pinus merkusii*, *Eucalyptus salignam* and *Altingia excelsa*. These plantations though not mature, are already yielding good revenue from thinnings which are in demand as fuel. The young plantations of *Pinus merkusii* are ready for tapping, and turpentine is distilled under departmental supervision. The distillation plants are very antiquated but whatever is being produced has a ready home market.

In very dry areas *Melaleuca* plantations are being extended on a reasonable scale and essential oil from the leaves is extracted by a crude process but yet is supposed to be a profitable proposition. Much research remains to be done to determine the best season for collection of leaves and for pollarding.

It is almost unbelievable to find that the Forest Service is able to carry out now a planting program of about 40,000 hectares annually against 12,000 hectares during the prewar period. Of course this program has been necessitated by the fact that during the Japanese occupation there had been widespread destruction of forests. Quite a large area of teak had been girdled under the "grow more food" campaign. The dead trees are now about 7 or 8 years old and their removal is an immediate necessity. This large scale program of reforestation is only possible under Java conditions where there is acute land hunger and big areas can be taken up for plantation under taungya system. The soil seems to be fertile and permits growing agricultural crops continuously for 2 to 3 years. The food production from these areas under taungya plantation is estimated to be about 50,000 tons per year.

It is surprising that the teak forests of this country have not many pests such as defoliators and borers. Further, the area does not suffer from fire which has saved all the valuable teak girdled some years back. One would have expected soil deterioration under exposure for such a long period but in practice this has not happened as most of the girdled trees send out coppice shoots which together with shrub growths free from fire have given the necessary shelter to the soil.

United States of America

● Since 1948 the state of Pennsylvania, through its Department of Forests and Waters; the U. S. Forest Service, through the Northeastern Forest Experiment Station; and the U. S. Geological Survey have together been carrying out a carefully planned forest and water research project. The general purposes are to determine methods of establishing commercial timber stands on the present brush-covered lands resulting from exploitation and repeated mining; to determine the effects on water yields of such conversion; to evaluate relationship between vegetative growth and disposal of precipitated water; to re-establish or replace chestnut which has been destroyed by blight; and to conduct intensive hydrologic studies on extremely small drainage areas.

Planting and direct seeding studies, involving various methods of site preparation, have been initiated, with particular emphasis on advance poisoning of undesirable species since thereby the top soil is less disturbed than when mechanical means are used. Natural regeneration is being encouraged. The geology and soils of the 2,000-acre (809 ha.) experimental area have been studied in detail. Recording devices have been installed to evaluate water gain or loss to the watershed and changes in moisture storage within the area. Ground water levels in test wells, rainfall interception by different densities and types of vegetation, water quality, and soil freezing will be determined as well as the usual elements of climatic data.

The results of all the studies are being analyzed promptly and kept up to date, and accumulated results will be published every two years, thus avoiding the usual delays in making available the results of such studies.

Forest Injuries and Protection

Mexico

● An investigation by FAO technical assistance officers of the high mortality rate of *Cedrela odorata* seedlings in commercial plantations in the province of Yucatan revealed that the primary cause was sunscald (excessive solar heat on tender tissue of young seedlings). An attack by a Buprestid beetle followed in the injured tissues of the scalded area and the insect's mining extended rapidly into healthy tissues, in association with unidentified fungi. Death of the seedlings was due to a combination of the three factors but sun-scald was the primary factor that needed to be prevented. Many surviving trees in the area had old canker-like lesions on the lower part of the main stem which had presumably originated from this kind of damage.

United States of America

● A United States Patent has been granted for a "device for setting and controlling backfires". The device, a unit designed for pulling behind a truck or other vehicle is capable of setting and extinguishing "backfires" at speeds up to 8 miles (13 km.) per hour in light fuels. Backfires are usually started to burn out the vegetation in front of an uncontrolled fire; when the fire reaches the burned-out area, it dies for lack of fuel.

Considerable interest in this unit has been shown by land management agencies where protection of large grass areas on relatively easy terrain is a primary problem. Burning instead of plowing a fire line leaves the soil unbroken, greatly reducing the possibility of erosion; it is particularly desirable along highway and railroad fire lanes.

One part of the fire-fighting unit that sets the backfires resembles a flamethrower. The other important component consists of a series of nozzles through which water is sprayed to put out the fire on the outside of the line. The backfire then eats back into the path of the main fire.

● A feature film in technicolor, "Red Skies of Montana," dramatizing the work of the U. S. Forest

Service "smoke jumpers," has recently been released by the producers, Twentieth Century-Fox. A special effort is being made by the Forest Service to draw attention to commercial showings of the picture which accurately portrays the smoke jumper's part in fire control. Qualified forest officers served as technical advisers during the making of the film.

● In Pennsylvania, the fire control programs of about 40 years ago were faced with general gross carelessness and active and heedless use of fire. Between 1911 and 1915, the average annual rate of loss was about 2 ½ percent of the protected area, compared to the 0.1 percent which is now regarded as the correct objective. Attention thus was early centered on the widespread problem of preventing fires, both through educational and propaganda effort and through physical measures such as fireproofing the railroads, which were a major cause of fire.

As experience accumulated, and as starting points of man-caused fires were plotted, it was found that 48 of the state's 1600 townships, while containing 5 percent of the total forest area, accounted for 35 percent of all fires. Special prevention efforts were therefore made in these townships through assignment of special prevention officers, distribution of propaganda material, and by other means. As a result, during the past 15 years the number of fires in the "problem townships" has been reduced to one quarter the number occurring during the early 1930's. Elsewhere, less intensive methods of prevention have been consistently applied. More recently, the number of fires per township accepted as a measure of "problem status" has been reduced and special effort devoted to the township thus identified. Altogether, the numbers of fires grew to a peak of 3,700 per year in the period 1931-35 and have since been reduced to 1,400.

The expanding fire suppression program has reduced the size of the average fire from 340 acres (138 ha.) in the period 1911-15 to 26 acres (10 ha.) in the past five years. Total area burned has been reduced to one tenth of the 360,000 acres (145,000 ha.) formerly burned annually, and forest area burned is down to 0.25 percent of the former annual total. The process of continuing or periodic analysis of the results has been a consistent feature of this 40-year program and has clearly resulted in realistic diagnoses of the localities primarily requiring attention and the form of attention most likely to succeed.

● Fires in southern pine areas commonly spread with great rapidity, and it was early evident that suppression by hand labor alone was insufficient to prevent severe losses, particularly if the successes in fire control resulted in leaving behind even more inflammable material.

During the past 15 years, therefore, several major advances have been made in meeting this problem, including systematic use of fire danger meters; development of radio and its use; development and use of power fire line equipment, which, with a crew of 3 or 4 men produces line as rapidly as 40 or more trained and fresh men using hand tools, and holds burned area to about 20 percent of that under hand operations. In addition, the several states concerned have increased their fire budgets by over four times during the past decades, and far more effective training of fire control personnel is now given through co-operative programs of the various federal and state protection agencies. Prescribed burning is widely used in the southern United States as a silvicultural tool and has had the principal effect on fire control of adding to knowledge of fire behavior under different circumstances and serving as a field training ground for fire control officers.

Both experiences show clearly the critical importance of fire prevention programs aimed at the particular attitudes and practices of particular areas or regions; the critical importance of continuing analysis of results to date; the necessity for imagination and ingenuity in devising new methods of both prevention and suppression when older methods prove by experience to be inadequate. The major conclusion is that, given these qualifications, continuing progress toward really effective fire control can be made, no matter how severe and apparently hopeless the initial situation may have appeared.

Advances in mechanization of various types continues to be rapid. Among those of general interest is the growing practice of using disposable cups, plates, knives, forks and spoons at fire camps to save time, labor and breakage costs; the experiments under way in using disposable sleeping bags made of crinkled kraft paper at fire camps; the testing of a new powered brush-cutting saw weighing 26 lbs; the testing of a new powered fire line building machine which weighs 265 lbs. and will operate on rough ground up to 58 percent in slopes.

Mensuration and Surveying

Canada

● The Research Division of the British Columbia Forest Service has developed site-class volume tables as an aid to assessing the log content and grade of standing timber of Douglas fir, Western hemlock and Western red cedar. Until recently, grade-cruising has been a personal art possessed by a relatively few highly-experienced timber cruisers. Results could be checked only by measurement of timber after removal, and this kind of visual survey could not be taught to the part-time employees who must do most of the cruising on Crown lands. The method, on the contrary, can be taught to quite inexperienced cruisers.

Forest Management

Pakistan

● The *Pakistan Journal of Forestry* reports that, considering how difficult it is to persuade owners to surrender their private lands for management by the Forest Department, it is really very creditable that in the North-west Frontier Province as much as about 50,000 acres (20,000 ha.) of such land has so been obtained. In addition, many other Government waste lands and civil *rakhs* have also been brought under Forest Department management. The biggest of such areas is the famous Rakh Shaikh Budin in Dera Ismail Khan District which is about 45,000 acres (18,000 ha.). A scheme to afforest it gradually has been sanctioned and is to be jointly financed by the Central Government and the Province. Work has already been started on this scheme.

Another of the many useful schemes which deserves mention is the plantations of *Acacia catechu* (Khair) in the scrub forests of the Province. The tree occurs naturally in these forests but is not plentiful nor was it much thought of in the past. The demand, and hence the price, of Khair has risen rapidly and is expected to stay high more or less permanently. Plantations are therefore very much "the thing" for the present, and in this Province about 500 acres (200 ha.) are being planted yearly.

United States of America

● During the past fiscal year the 73 million acres (29.5 million ha.) of commercial forest land within the National Forests produced gross receipts from timber of $65 million, whereas cost of administration, including the return of 25 percent of gross receipts to local governments, was $53 million, thus leaving a net profit to the Federal Treasury of $12 million. Many National Forest areas, totaling 108 million acres (43.7 million ha.) are set aside and managed primarily for values other than commercial timber, notably watershed protection. These lands involve an annual expenditure of $26 million a year, including returns to local governments, although many of the values and services do not result in direct payments to the Treasury.

Gains in capital value of the forest, based on fantastic recent increases in sale values of timber stumpage, have been remarkable. The spectacular increase in dollar returns from these public properties may stimulate the authorities who are responsible for appropriating

funds to make possible the required levels of protection, development and management which were never attained during the long period when the National Forests' receipts did not equal expenditures.

● One of the rangeland areas in dispute between the U. S. Forest Service and the range livestock industries has been on the Roosevelt National Forest in the state of Colorado. The public lands were given National Forest status in 1917 after a half-century of abuse from overgrazing, fire and cultivation of sloping lands, and were at that time in a badly deteriorated condition. Management measures were applied, but by the end of the 1930's studies showed that deterioration of watershed and grazing values had not been stopped. Restrictions on range use were introduced, beginning in 1940, and these led to considerable controversy. As a result, the National Forest Advisory Council was asked to examine and report on the ranges in 1949; it recommended that the uses of the land should be given the following priority: 1) watershed values; 2) recreation; 3) grazing; and 4) timber uses.

In the following year, technical officers of the U. S. Forest Service made a detailed study of two selected range units to evaluate the effectiveness of the changes in stocking made to date, so as to determine what additional adjustments or other measures might be needed to obtain desirable range and watershed conditions.

It was found that 96 percent of the useable range was in unsatisfactory condition, but that the trend in forage condition was upward of 78 percent, thus giving some indication that continuation of the present levels of stocking was probably desirable, both for forage production and for improvement of watershed conditions, specifically infiltration capacity of the soils and prevention of erosion. It is proposed that a moderate program of supplementary erosion control be applied to speed up the stabilization of the gullies which presently are major contributors to erosion. In addition, better management of livestock on the range is needed, and control of the size of wild herds should be worked out.

● One of the prime purposes of the forest survey of the U. S. A. is to obtain facts on forests and forest resources and, by combining these with other economic data, to provide a basis for analysis and planning in local, as well as state and national, governmental units. Analysis of the individual county unit has developed the form of combining strictly forest inventory information on forest areas, types, densities, age classes, and site quality, with data on the distribution of ownership of forest lands, both as to kind, intent of ownership, and size classes of ownership.

Recent examples of this type of report for two counties in California show the great differences which exist and which will have to be taken into account in any subsequent efforts to ensure proper forest management. Difficulties in the way of obtaining rational land use include the variable proportions of commercial forest area in public or in private ownership; the fact that substantial proportions of land in private ownership are held for recreational use or as incidental parts of farm properties, with little interest displayed by the owners in proper timber management; and the fact that the large numbers of small holdings aggregate a considerable proportion of the total commercial forest land. Obtaining these primary facts at least represents a solid starting point for intelligent efforts towards proper forest conservation.

Industry and Trade

Chile

● The lack of co-operation between the different forest industries and their technicians provides one reason for the relatively low standards and sporadic activities of the forest industries in this country. There are signs that timbermen are recognizing the importance of co-operative work. In the *Revista Forestal Chilena*, a two-year-old Chilean forestry review, mention is made that the first local timber association in the country, ("Associacion de Madereros de Villarrica") was founded in the province of Cautin, in January 1952. This will probably be the signal to start organizing similar associations in other timber centers. The *Revista* is making energetic efforts to establish a national forestry association, "Sociedad Nacional de Forestadores y Madereros". Such an association could render valuable assistance in improving the forest industries, especially the sawmills, of Chile.

Panama

● A company has been established, with the aid of foreign capital but using local labor, to undertake large-scale exploitation of Mangrove bark. The company intends to treat about 200,000 tons of bark annually, the value of which is about $ 27.50 a ton. The bark, pulped by a patent process, is to be used as a wetting agent in the treatment of oil-bearing sediments.

Forest Products and their Utilization

Australia

● Introduced slash pine (*Pinus caribaea*) and loblolly pine (*P. taeda*) from 20-year-old plantations in Queensland, Australia, have been found to be similar in properties, with slash pine slightly the superior. Both, however, are inferior to the same species grown in their natural environment in the U.S.A. and in plantations in British Honduras. They are comparable to plantation-grown *P. radiata* from South Australia but slightly inferior to hoop pine from the same state.

Borneo

● The following extract is taken from *White Man Returns*, the latest book by Agnes Keith, wife of H. G. Keith, FAO technical assistance officer directing the Mechanical Logging Training Centre in the Philippines: "Today, the most satisfying source of revenue to both natives and Government is the harvesting, sale, and export to China of birds' nests from the fifteen famous cave groups of North Borneo which are a byword wherever birds' nest soup is sipped. The bird's nest industry now brings yearly to this country almost 100,000 dollars, plus a goodly sum for export duty, all acquired at the expense of the birds alone.

The vital ingredient of bird's nest soup is not feathers, sticks, twigs, or grass — but, as is known to epicures, it is the inspissated saliva of adult swiftlets. This is a secretion from the salivary glands of certain swiftlets, with which they make their nests. The saliva hardens on exposure to the air into something like isinglass, and this is the edible ingredient of birds' nests.

Nests are attached at great and inaccessible heights inside the inky chambers of the limestone caves when the nest-building urge comes to the small, dark-plumaged, white-bellied swiftlet...

Birds' nests are classified in North Borneo as forest produce, and in most cases the caves are in Forest Reserves. For this reason the harvesting, revenue, responsibility for and conservation of the industry, except in the case of a few native-owned caves, is in the hands of the Forest Department."

Pakistan

● In East Pakistan the chief source of supply of timber is the natural forest of the Chittagong Hill Tracts. These areas are inaccessible and their proper development requires the building of a road system. This would serve also to develop the agricultural possibilities of the hill tribes reserve where shifting cultivation is practised. An FAO technical assistance officer has carried out a survey of the possibilities of this area and concluded that there was, indeed, great potential forest wealth but since there were no forest industries, no extraction of secondary species could at present be carried out. Many of these appeared suitable as raw materials for plywood, matches, chipboards or fibre-boards, all at present imported at high cost. Since breakdowns are frequent in all tropical logging operations, the officer

did not recommend any increase in mechanical logging until a proper organization for repair and maintenance had been built up. The installation of a road system was the first step towards utilizing the secondary hardwoods and could probably lead to doubling the output of the forests.

Utilization is being aided by an FAO sawmilling expert who has planned the re-organization and management of a sawmill in the Chittagong area. This specialist (F. Cermak, France) has also advised replacing hand-sawing in the forest by portable sawmills, such as the French horizontal bandsaw *La Forestière* or the German horizontal chainsaw *Dolmar*. At present the average daily output of 1 in. boards by hand-sawing is 1.5 to 2 cubic feet per man, costing 1 1/2 to 2 rupees ($ 0.45 to 0.60) per cubic foot. Crews of 2-8 men break up logs in the forest into flitches and cants and these are then floated to consumption centers for re-sawing.

Portable mills cannot produce high grade lumber economically but neither can the stationary mills unless special sawing methods are introduced. Quarter sawing giving the best grade results, is too expensive. Methods found valuable in West Africa are recommended.

Trinidad

● A comparison of properties of teak (*Tectona grandis*) grown in Trinidad and in Burma has been reported by the Imperial Forestry Institute, Oxford. Tests dealt with static bending, toughness, compression parallel to grain, hardness, and tension parallel to grain, and the resulting mechanical properties. In all cases, the mean value of any particular strength property was higher for the Trinidad-grown material than for that of Burmese origin. The Trinidad teak was 1 pound per cubic foot (16.02 kg. per m^3) heavier than the Burma teak, but this difference does not wholly account for the determined figures on strength. It is concluded that the present silvicultural techniques in Trinidad are satisfactory for producing timber which is superior in strength to natural Burma teak.

United Nations

● The General Assembly Building in the center of the plot which houses the permanent Headquarters of the United Nations in New York will be completed by September 1952. In its rotunda about 25,000 bd. ft. [59 m^3 (s)] of salt treated lumber were installed and similarly treated lumber was used in the two elevator machinery penthouses situated to the north of the dome. The sheathing consists of dressed 1-inch western white spruce, pressure treated with 0.35 lb. of Wolman salt per cubic foot [5.6 kg/m^3 (s)], to form a proper base for attaching the copper finish material which overlies the dome and drum of this building.

United States of America

● Studies in chemical debarking of pulpwood in the state of Washington are following the methods developed in other forest regions. The primary purpose is to facilitate bark removal at any time of year, particularly on young, small, fast-growing trees which are not effectively handled by the usual hydraulic debarking method. A secondary purpose is to reduce the weight of wood, thus permitting larger loads for greater hauling distances. In the experiments, sodium arsenite has been applied in axe-hacked girdlings. So far western hemlock, the true firs, black cottonwood and western red cedar have reacted most favorably, whereas red alder has shown no separation and Douglas fir offers no encouragement. The work is being continued and expanded to include additional species and the economic aspects of the process.

Forest Policy

Brazil

● The Minister of Agriculture appointed a Commission in 1950 to examine the problem of supplying the iron industries in the state of Minas Gerais with fuelwood and charcoal, which are used almost exclusively in the ore refining processes. Compared to total fuelwood consumption in Brazil, which is about 93 percent of all wood consumption, the smelting works use only a very small proportion. Nevertheless the enquiries of the Commission revealed that in 1950 the 13 works in the State used 1,121,690 m^3 of charcoal, 82,978 steres of fuelwood, and 21,427 m^3 of industrial wood for the processing of around 51,000 tons of ore. Nearly all the companies own extensive forest tracts to supply their needs (the largest being nearly 150,000 ha.) and these are theoretically cut over on a 25 year rotation. Considerable quantities of charcoal are also purchased on the market.

In 1948 over the whole State about 35 million m^3 of wood were extracted from a forested area estimated in 1933 to be about 15 million ha. Since in addition portions of this area suffer annually from fires, the natural forest obviously cannot sustain this drain indefinitely. The forest owned by the companies themselves can probably produce adequate supplies for only 4 or 5 more years, but even so, distances and transport costs will make extraction increasingly expensive.

In the light of these circumstances, the Commission considered that eucalypt plantations, on the scale and following the methods of the Railway Company of Sao Paolo, offered the only solution. The yield from these plantations at an age of 7 [illegible] is around 250 m^3 per ha. [illegible] Commission therefore drew up [illegible] for each of the iron companies [illegible] volving the planting of 93,00[illegible] over 10 years. Some companies [illegible] already started operations and [illegible] biggest employs a well-organized for[illegible] est service, with complete facilities for its forest workers. The cost of the plantations, at 2,500 plants per ha., will probably vary widely according to the manpower available; estimates range from 2,500 to 7,500 cruzeiros (about $125 to $375 per ha.). The Commission is also proposing plantations for various Railway Companies of the State.

Fiji

● An official Committee on Forest Policy has recently set up a plan of action for forestry in Fiji. The two main objects are to raise the level of future expenditure to a figure enabling some creative forestry to be attempted and to set up a series of specific goals for forest policy. Formerly, at least on the unofficial side, the atmosphere has been hostile to forestry and earlier attempts to make progress have been unsuccessful. The task faced is far from simple. About one-half of the area is in the tropical rain-forest zone; much of this is inaccessible, and the rest has largely been degraded by continuous exploitation; satisfactory regeneration techniques have not been established. In the dry zones, cultivation, and especially fire, have destroyed the forest and the ground is occupied by grass or weeds. Restoration of tree cover will have to be accomplished by planting. During the past half century at least one third of the timber requirements have had to be imported. To make Fiji self-sufficient in the long run, large capital investments in plantations and their tending would have to be made. The present plan is for planting about 2,000 acres (800 ha.) per annum. An expansion of senior staff is proposed, a training center, and the purchase of equipment. The present area of constituted reserves is only 1.8 percent of the total land area and, even if all areas already preliminarily notified or as yet under discussion were constituted, there would still be only 6.2 percent in constituted reserves. None of the reserves have been demarcated on the ground and they are encroached on by logging and shifting cultivation.

Haiti

● There are many examples of irrigation schemes where the dam is built to impound a body of water and little thought is given to the stabilization of soil and the reduction of the silt load in the river. In these cases after a few years the efficiency of the dam is impaired by heavy silting. In Haiti the government has very wisely initiated a program of afforestation, erosion con-

trol and conservation farming in the watershed *before* the dam is even begun. In this way the government hopes to have reduced the silt load of the Artibonite River from its estimated 10 million m³ per annum to something that is less frightening and less threatening to the efficiency of the dam.

India

● An official statement of forest policy for India has been in existence unchanged since 1894. But forest policy must inevitably change with the times. In India a review of forest policy was patently necessary, not only because of changed political circumstances but also because the experience of the past needed to be newly assessed to reveal how the future development of the country could best be charted. As the result of the co-operative efforts of the constituent States, a new statement of forest policy for India was enunciated on 12 May 1952. This is an event of great significance, not only for India but for all the countries of south-east Asia and, indeed, all the Member Governments of FAO. An analysis of this statement of forest policy will be published in a forthcoming issue of *Unasylva*.

● The great Rajputana desert which covers about 80,000 square miles (21 million ha.) is encroaching towards the fertile plains of the Ganges at a rate of about 800 m. a year, over a front of 160 km. A committee has been set up by the Minister of Food and Agriculture to plan counter measures and the National Institute of Sciences has studied the ways in which afforestation has already served to protect agricultural lands and arrest the desert's advance.

The Commission has recommended establishing an experiment station at Jodhpur under the direction of the Forest Research Institute, Dehra Dun. The station is itself to be responsible for making plantations to provide local populations with fuelwood, small timber and grazing for livestock, and for creating windbreaks. In particular a forest belt 8 km. wide and 640 km. in length is to be established along the west frontier of Rajasthan.

These works will be under the Central Government but the State Government is also recommended to increase forest areas and plant accessory windbreaks and shelter belts. Amongst the species that can be used for plantations under the difficult desert conditions are *Prosopis juliflora, Azadirachta indica, Ailanthus altissima,* and *Albizzia lebbeck.*

Kenya

● Commercial planting of exotic conifers began in Kenya soon after 1920 and is now proceeding at an annual rate of over 6,000 acres (2,400 ha.). *Cupressus macrocarpa, C. lusitanica, Pinus radiata* and *P. patula* are the most successful species, growing at rapid rates and, on a rotation of 35 years, producing a final crop averaging about 20 inches (50.8 cm.) d.b.h. The trees to form the final crop are pruned to produce clear lumber; thinnings are considerable and are absorbed by the market. The cost of establishing plantations is very low, being done under the "shamba" (i.e. taungya) system whereby cultivators are required to establish the trees and tend them until cultivation shifts to another area.

The Forest Department aims at organizing a 5-10 thousand acre (2-4,000 ha.) forest in each district, each as a "normal" forest with a complete series of age classes. Such a forest of about 7,000 acres (3,000 ha.) would supply annually about 1.4 million cu. ft. (40,000 m³) including thinnings, and would support a large sawmill operating permanently and thus capable of being efficiently organized. If stumpage is sold at reasonable rates, the plantation investment would earn at an estimated 8-10 percent compound interest rate, a higher rate than that at which capital need be borrowed.

The present program is to plant 210,000 acres (85,000 ha.) in 35 years, and of this total 45,000 acres (18,000 ha.) had been planted to the end of 1949. To create a "normal" forest in each district would require considerably more than 35 years.

No complete survey of the existing forests has ever been made and one is badly needed. Partial and preliminary work indicates that as much as 235,000 acres (95,000 ha.) suitable for commercial planting may be found in one division alone, and the total suitable area in Crown Forests may be as much as a million acres (400,000 ha.).

In addition to the commercial coniferous plantations, the forest estate is divided into: (*a*) merchantable indigenous forests from which most commercial supplies are now being taken; (*b*) non-commercial indigenous forests having protective values which must be guarded under the agreed forest policy; (*c*) fuel plantations, mostly of eucalyptus; (*d*) native forest reserves. The native reserves are operated at a loss, as are the protection forests, and some of the fuel plantations are now superfluous.

Liberia

● The United States Economic Mission to Liberia, which started its work in 1944, has undertaken a survey of the forest resources that are the least surveyed and most poorly described in West Africa. Over two years an attempt was made to determine approximate age, volume, composition, quality, distribution, and exploitation possibilities of the forests and to recommend a program for protection, development and rational utilization. Aerial photographs covering nearly all the country were used in planning the field work, but their use was limited because the closed canopies of the high forest prevent complete data being obtained. Major water drainage systems could, however, be readily determined from the photographs. Forest areas were classified as low bush, including areas recently farmed with no true canopy and covered with tangled growth; broken bush, including areas where the high-level canopy was broken and gross merchantable volume was 5,000 board feet or less per acre (56 m³ per ha.); high forest, including areas with an unbroken closed canopy with volume exceeding 5,000 board feet per acre (56 m³ per ha.), the latter subdivided by 5,000 feet classes.

In the field work, one acre plots 33 feet wide (0.4 ha. 10 m. wide) on each side of the trail were made and selected sample plots were measured in the higher volume forests. Merchantable trees were defined as those with a minimum diameter of 2 feet (61 cm.) outside bark above butt swelling and containing one or more merchantable logs. Volumes were estimated by the International 1/4-inch log rule. It was necessary to undertake dendrological work, and 235 species were identified and cross-checked, where necessary, with major reference collections such as the Kew Herbarium in the United Kingdom. This work added greatly to the primary knowledge of Liberian forests and trees.

Rainfall is a dominant factor in forest vegetation. In the belt near the coast, receiving over 125 inches (300 mm.) of rain annually, there are typical evergreen rain forests; further inland, in a belt receiving from 75 to 125 inches (200 to 300 mm.) there are deciduous forests; and in the northern areas with less than 75 inches there are savannah-type forests intermingled with grasslands.

It was necessary to estimate population, and this was done by hut counts and sampling of the average number of occupants. This, though a meager basis, indicated a total population of between 1 and 1.1 million. The total working population of able-bodied adult males is probably not over 150,000, and no more than one third could be diverted from subsistance agriculture.

Transportation of all types is seriously lacking. Motor roads reach only a small part of the forest area, and most of these are not good enough to permit heavy duty log or lumber hauling. The useable road system taps no more than 5 percent of the useable high forest area. A deep water harbor, recently opened, could be a great stimulus to timber development and trade. At present, foot trails and head loads are the lifelines of interior Liberia, loads averaging 50 pounds (23 kg.) and daily mileage about 25.

There has never been a significant forest industry. Logs were exported in the 19th century, and limited timber utilization in the immediate coastal areas has gone on during the present century. There are only a few small circular sawmills operating intermittently. Wood exports are valued at only one sixth of the

$75,000 paid for imports. Annual consumption of fuelwood is 45 million cu. ft. (1.27 million m³), 95 percent of which comes from dead or dying trees on farm clearings; secondary uses absorb 2 million cu. ft. (56,000 m³) of timber annually, and a wide variety of minor products used as food, medicine or for household purposes comes from the forests. Domestic markets are small.

There is much raw material for large-scale commercial forest operations. The current British and French trials with West African woods is adding greatly to the knowledge of Liberian species and may eventually lead to commercial acceptance of species not now utilized.

Originally from 90 to 95 percent of the country was covered with high forests. At present, high forest area is only 38 percent, broken bush 20 percent, low bush 22 percent, and non-forest, which includes cleared cultivated plantation and inland water areas, 20 percent.

There is no simple or readily applicable system of type classification for the forests, but broad vegetational zones may be used to divide the country into coastal forest and mangrove swamps, 2 percent; evergreen rain forest, 47 percent; transitional forest, 10 percent; deciduous forest, 40 percent; savannah and park forest, 1 percent.

The conservation problems include the setting aside of a forest estate, establishing silviculture and management, controlling use of land for agriculture, curbing fire used in conjunction with agriculture, and other lesser factors as well.

Commercial exploitation depends above all on construction of roads or other means of transportation, and development of markets for currently unknown or secondary woods. There are additional associated resources — water, wildlife and fish — which can become valuable for the people of the country.

United States of America

● The Chief of the U. S. Forest Service has announced, as reported in the last issue of *Unasylva*, a comprehensive review of the timber resources of the United States which will be completed within two years. The last similar review was based on data up to 1945, and heavy use of forests since then has made the new project necessary. It is proposed to bring information on timber resources up-to-date; to re-analyze prospective requirements, supplies and growth of timber; appraise current timber conservation programs; and set out a future course for American forestry. Advice and help will be sought from all appropriate agencies, industries and conservation programs.

The recent publication of forest survey reports for individual states and regions gives special emphasis to the need for the truly comprehensive nation-wide job now planned. This is particularly true where resurveys have been completed after 12 to 15 years, thus giving two points in time and identifying trends in local situations. For example, such data are now available for two southern states, Mississippi and South Carolina, in both of which forests are of great importance both regionally and nationally. In Mississippi it is found that the timber products industries rank just behind farming as a major part of the state economy; that, although forest acreage increased 2 percent between surveys, timber volume, quality and size decreased, total volume declining 10 percent and sawlog volume even more. Sustained heavy use of forests continues, due to overcutting, the use of smaller, poorer quality and formerly less desirable trees and species, and by expanding output of secondary products. Most management on the 90 percent of the forest in private ownership is poor, although there is good management on larger industrial holdings; present outlook is for contraction in important wood-using industries unless management improves rapidly; better management can eventually create a resource capable of meeting all foreseeable timber needs, and better cutting practices, utilization, protection against fire and grazing are major elements in improving management.

In South Carolina, with 62 percent of the total area under forest, the re-survey shows that the situation is broadly similar. Total timber volume decreased 5 percent and saw timber volume by 10 percent and by more in certain areas; timber use for pulp and lumber, veneer and other products has expanded greatly; severe overcutting, particularly of the best timber but also of smaller pole timber as well, has increased; growing population and increasing income indicate that no reduction of forest drain is in sight; forest growth is far short of the potential, the measures required to improve it being similar to those in Mississippi and elsewhere.

Reviews

It is the policy of FAO to review here only selected publications which appear to have a direct bearing on the current work of the Forestry Division.

Forest Inventory. Stephen H. Spurr. 476 pp. illus. Ronald Press Company, New York. 1952. U.S. $ 8.50.

Several recent books have undertaken to bring up to date the application of the latest techniques to forest inventory problems. This work makes no pretence at covering the entire field in detail but concentrates on the two key problems of estimating total gross volume and growth per acre, for either a given species or a given forest type. Together these form the basic biological problems that must be solved before consideration is given to subsidiary economic aspects.

Extensive forest inventories are necessary before management can be properly applied, and it is to the principles of such inventory work that main attention is given. The author has done original work in air photography inventory methods (See *Unasylva*, Vol. II, No. 4; *Aerial photography* by Stephen H. Spurr) and in other aspects of mensuration, but is concerned here with low cost inventories which can be readily financed and which will at least provide a basis for forest management.

Accuracy in inventories is affected by errors in the field measurement of trees and stands, in translating these into volume and growth, and in the method of sampling used to obtain primary measurement. An inventory must be so conducted as to reduce each type of error, in accord with the principle of consistent accuracy. The author has taken account of experiments and experience in many countries, and reports and analyzes them. The methods used in national inventories in Scandinavia, Great Britain and the United States are considered.

This is a thoroughly competent reference work on the principles and methods of forestry inventory and is far more detailed than the FAO Study *Planning a National Forest Inventory*.

AMERICAN FOREST POLICY. Luther Halsey Gulick. 252 pp. Duell, Sloan and Pearce, New York. 1951. Price $ 3.50.

At an early stage American forest policy and administration advanced boldly into doctrines, methods and attitudes which at the time often appeared radical, and placed the Federal government in a then highly-advanced role. The creation and administration of the national forest system from lands still public, its expansion by purchase and exchange of private lands; inauguration of Federal grants-in-aid, to stimulate and nourish State efforts for the protection of private forest lands; adoption of decentralized administration on the national forests in lieu of full centralization at the nation's capital; building a professional body of officers with a determined policy from the very beginning; aggressive leadership in formulating and pushing ahead with ideas and methods — all these have combined to make a definite pattern and indeed a test, not alone of forestry itself, but of public administration as illustrated by forestry.

American Forest Policy is a thoughtful and certainly controversial attempt by an eminent student of public administration to derive general conclusions from the experience in forestry, conclusions which may be applicable to other public ventures, and to the current trend towards increasing Federal government responsibility for all good things. Several searching and difficult questions are raised:

1. When a government tries to regulate or take over any particular section of the economy, does the public get what it wants? The objectives vary but may include better service, stabilized incomes, security of employment, freedom from monopolies, better management, cheaper service costs, more public-spirited direction, and better distribution. Are such ends, when sought, actually attained?

2. When government enters what was formerly the sphere of private enterprise what happens to the economy? Is private action upset? Does the government have to take over the entire operation in due course? Or do public action or regulation and private activity continue to work side-by-side in some sort of equilibrium?

3. What happens to technology and the advancement of the arts in the part of the economy thus affected by government action? Does such action result in technological stagnation, or does it accelerate progress?

4. What administrative problems are created for a government by the assumption of these new lines of activity?

5. What new political problems are raised?

Forest policy today is to be found in no neat document, but rather in what is being done because it receives general acceptance. Many policy questions are broadly settled: the public interest in forest lands requiring positive government action, including public ownership and management but not extending into wood-processing, positive price policy; price support policy or export-import policy; sustained yield and multiple-use protection research; technical assistance; support to local governments; mass education in forestry. Unresolved issues in forest policy include control over private cutting and management; expansion of public ownership; and the public construction of access roads.

There are several unsolved administrative issues, and much of the book deals with them. They include the division of work between the central government and the states; the allocation of the work within the federal government; the methods of decentralizing forest programs to secure adaptation to local needs without sacrificing a national policy; the best method of securing local harmony among differing national and state programs; the relations between central specialized staff and local technical officers; the relation of research staffs to operating staffs at all levels of administration; and the efficacy of benefit payments in comparison with other approaches designed to stimulate private forestry.

Appraisal of successes and failures has to examine the major objectives of policy. These are:

(1) Enough suitable wood at reasonable prices. Here a detailed analysis concludes that there is no danger of a wood famine in the U.S.A. — despite the scare tactics of some conservationists and professionals. This conclusion has already been challenged, both as a fact and as a test case of an expert in one field venturing into another field with which he is not fully familiar.

(2) The provision of forests and trees for the "other forest values," generally so far only limited and partial success.

(3) Economic welfare of forestry and woodworking activities, in which partial progress is taking place.

(4) Scientific and technological advance — strong in the forest-growing phase, weak in the economical use of timber.

(5) National and regional security — no timber famine nationally, but an unsatisfactory situation in some regions.

(6) Conversion of the people to a sense of responsibility in land ownership — despite progress, the saddest area of failure and a major point of attack for the future.

The methods used in programs — such as professional education, federal state co-operation, state forestry, education of landowners, private ownership, decentralized administration — show variable degrees of success as well. On the whole, policy and programs are considered to be achieving their objectives.

But new approaches are needed, above all to instil a love of the soil going beyond the profit motive, regulation, propaganda or technical advances — and this is by no means a forestry problem only. A comprehensive land use program is needed, rather than an aggregation of fractions; better protection needs to be accepted by the public; a new program for joint land purchase by the State and Federal governments is required; there must be a more rational application of the multiple-use doctrine, some restoration of responsibilities to the States, the consolidation and improvement of management of Federal forests, and public measures to strengthen private forestry.

An interesting conclusion is that the "professional bureaucracy" has become the policy maker — contrary to Constitutional theory — and that the Executive and Legislative branches of Government are the balance wheel, explaining the expert to the public and vice versa.

While progress has so far certainly settled some policy issues, others are left unresolved, and new ones have been created, notably the question of effective methods of co-operation between Federal and State governments and private ownership, which is political-economic in character. Forestry has thus brought to the fore many problems not anticipated when the Government embarked so extensively into the economic field.

This book by a student of government brings a too rare set of criteria to an appraisal of the forestry venture and to the setting forth of its larger significance. Foresters should study it. Some professional *amour-propre* will be violated by the quite definite judgements of a non-member of the profession, but it is hardly to be doubted that foresters will be the better off for seeing themselves as others see them, and for pondering over the larger meanings of their theories, doctrines, ambitions and methods.

Corrigendum — *Vol. VI, No. 2*, page 96, end of column 3: sample rates for Centralized Title Service to the U.S.A. should read as follows:

		By air (flimsy) annually	Surface Maill (cards) annually
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	(B)	$ 20.00	$ 20.00
	(C)	$ 33.00	$ 33.00

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Forest Soil Research in Finland. (IV, 3)

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Better Conditions for Rural Populations in Tropical Areas. (V, 3)

AUBREVILLE, A.
Technical Assistance in the Development of Tropical Forests. (IV, 4)

COHEN, W. E.
Pulp and Paper from Australian Eucalypts. (II, 6)

CRANE, JACOB L.
Huts and Houses in the Tropics. (III, 3)

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United Nations

PROCEEDINGS OF THE UNITED NATIONS SCIENTIFIC CONFERENCE ON THE CONSERVATION AND UTILIZATION OF RESOURCES.

17 August - 6 September 1949, Lake Succes, New York.

VOLUME V, FOREST RESOURCES

Published by the United Nations Department of Economic Affairs, New York, 1951. pp. 325. Price $3.00. Obtainable from United Nations, New York, N.Y., U.S.A.

This volume of the proceedings of the above Conference contains a most valuable collection of papers contributed by forestry experts from all parts of the world. The principal forestry subjects discussed at the Conference were forest inventories, protection of forests, forest management, protective functions of the forests, administration of forests, logging and sawmill techniques, and preservation and chemical utilization of wood. A summary of the discussion of each subject is presented with the papers. Statistical tables, charts, photographs and short bibliographies are also included. A list of contributors to the Forest Resource section completes the volume.

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